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PROCEEDINGS

ex Dept Report #22

OF A

CONVENTION OF AGRICULTURISTS,

HELD IN THE

DEPARTMENT OF AGRICULTURE,

JANUARY 10th to 18th.

WASHINGTON:
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1882.

CONVENTION OF AGRICULTURISTS.

In July last the Commissioner of Agriculture forwarded the following letter to a large number of agriculturists throughout the country:

UNITED STATES DEPARTMENT OF AGRICULTURE,
Washington, D. C., July 26, 1881.

SIR: It is my purpose to call together in convention, to be held in this Department during the coming winter, such representations of the various branches of agriculture in this country as the leading agricultural associations may select as their delegates.

I wish to meet those who are interested in and skilled in the breeding, feeding, and sale of cattle; those interested in and skilled in the production of the cereal crops of the country; those interested in and skilled in grape culture and the manufacture of wines; those having charge of the agricultural colleges, agricultural societies, and the educational agricultural institutions of the country, for the purpose of discussing the general welfare of agriculture and the various divisions of the industry to which I have alluded.

I shall feel under great obligations to your association if, at any meeting held this autumn, it will choose delegates to these conventions who are qualified to take part in the proposed deliberations.

The first of this series of conventions will be held on January 10th, and will be devoted to the colleges and agricultural societies for the discussion of the general principles of farming and of those questions which belong to agricultural education and the organization of schools, colleges, and associations, and will continue two days.

The second of the series will meet on the 12th day of January, and will be devoted to the discussion of the animal industries of the country, and the various modes of breeding, feeding, and dealing in horses, cattle, sheep, and swine. This convention will continue two days.

The third of the series will be devoted to a discussion of all matters relating to the cereal crops, and will commence on the 14th day of January, and continue two days.

The fourth of the series will commence on the 17th day of February, and will be devoted to the discussion of the management of the vineyards and the manufacture of wines, and will continue two days.

I would request your association to choose delegates to as many of these conventions as are of interest to your section of the country, and as will find representatives within the limits of your society.

Each convention will be composed of three delegates from each of the societies and colleges invited to be present—that is, three delegates to represent the colleges and associations, three delegates to represent those interested in the animal industries as above enumerated, three delegates to represent those interested in matters relating to cereal crops, and three delegates to represent those interested in the subject of the management of vineyards and the manufacture of wine.

Will you be kind enough to designate some person of your society who will be willing to read a paper before the convention which he is elected to attend, and notify me of your selection? Please send to this Department a list of the delegates as soon as they are chosen.

Very respectfully,

GEO. B. LORING,
Commissioner of Agriculture.

In compliance with the request and invitation contained in the foregoing circular letter, a large number of those interested in agriculture and kindred subjects assembled in the library room of the Department of Agriculture on the 10th day of January, 1882. At 11.05 a. m., of that day, the convention was called to order by Dr. GEORGE B. LORING, Commissioner of Agriculture, who said:

The convention will come to order. We all know that there is nothing so important in agricultural investigation in a country like ours as

proper comparison and careful conference with regard to the important questions that come before the farming community. We have a large surface extending over many latitudes, every variety of soil, and nearly every variety of production, from the northern latitudes down almost to the tropics; and it is absolutely necessary that a national convention of agriculturists should be composed of those who are interested in all the diverse agricultural interests that cover so much space and are inclosed in such a variety of climate.

I have thought it best, therefore, to divide this assembly into conventions among various branches of our agricultural industry. The first convention, which meets this morning, will be devoted to the discussion of agricultural education and the organization and purposes of agricultural societies, which I consider to be fully as important to the agricultural educational system of the country, in a practical way, as the colleges are in a scientific way. I have always been especially desirous that the practical and scientific in the agriculture of this country should go hand in hand. I know the value of scientific investigation as well as any man possibly can, and set as high a value upon it. I know perfectly well how the several branches of agriculture, with all their economies, have been systematized by the aid of scientists; and I am especially desirous that the same methods that have been adopted with so much success in other countries shall be adopted here. I desire that everything that can be done to increase our crops and economize our modes of living shall be done. And to this end this department will tender every encouragement as long as I have control of its affairs.

The value of practical information cannot be too highly estimated. It is the practical men who have been the pioneers in this great industry. They have leveled our forests, built our towns and villages, and it is through their demands that agricultural machinery has been brought in this country to that degree of perfection which is of so much value to the farmer and the source of such infinite admiration to every observer. There are nowhere in the world finer exhibitions of agricultural machinery than can be found at our annual fairs, brought there, acre by acre, upon the demand of the successful farmers of every section of this country. It is the practical men who have brought this about. It is they who, led by Mr. Johnston, of New York, have instituted "thorough drainage." It is they who have introduced the best breeds of cattle, and have increased, by the introduction of animals adapted to our latitudes, the wealth of this republic to an extent which the Superintendent of the Census informs me is almost incalculable. Now, the work that the scientists and that which the practical men have done should go hand in hand, and I have endeavored to combine both sides of this agricultural investigation in such a way that its result shall be felt not only by colleges and schools, but also on the farms themselves. I thought that it would be well, therefore, to divide the work. The convention that follows this will be devoted to the animal industries of the country—horses, cattle, sheep, swine—during two days. Two days will then be devoted to the cereals—the best kinds of wheat, corn, oats, barley, &c., and to the discussion of methods relative to the management of these crops.

Following that will come the discussion of what is named in the circular as grape-growing and wine-making, including, however, horticulture of all descriptions; one of the most important branches that you can discuss, embracing the careful cultivation of new plants, methods, and processes, and of ornamental and useful trees. I desire especially that the debate should be confined within the limits indicated

by the call, but I trust also they will be so extended as to include all valuable information upon the various points under discussion. The benefit which may arise from these conventions must be manifest. I think it was in 1872 that I was first called here to attend a convention similar to this, although not organized in a similar way, the result of which was, I think, a great stimulus to the agricultural industry and ambition of the country. It is now nearly ten years since that was held, but in that time the increase of the agricultural wealth of this country has been enormous. The agricultural machinery of that day was by no means as perfect as it is now. The reapers and mowers of that time did not reach the state of high finish of the present. The introduction of economical fertilizers has been vastly increased, and man has learned that in many instances he has under his own hands almost many natural fertilizers which he can use profitably if he will only apply them scientifically. We now know how to apply muck, clay, marl, all the various natural products lying within our own reach, economically and profitably.

The surprising growth of agriculture during this time has attracted great attention throughout the world. Ten years ago our crop of wheat was about 250,000,000 bushels; now it is more than 450,000,000 bushels. The crop of corn was then about 700,000,000 bushels. In 1880 it was 1,750,000,000 bushels. The crop of oats was about 230,000,000 in 1870. Year before last it was more than 450,000,000 bushels. Barley has doubled; rye has doubled; the whole grass crop has doubled. The great dairy industry of the Northwest has developed in the past ten years to an unparalleled extent. Now, the reason for this incalculable growth is that every man is engaged in his own industry, for his own good, responsible to his country and to the society in which he lives, and stimulated to the laudable ambition of making himself a good farmer and a good citizen. Within this decade the attention of one section of this country has been earnestly and anxiously turned to the best methods for developing its agricultural industry; and the result of this investigation and thought is that the successful, painstaking farmer there has determined not to confine himself to one crop alone, but to diversify his crops and products, so that not a month shall be lost in conducting his business, nor an opportunity be lost by which he can become a prosperous American agriculturist.

All that I have hastily outlined, and more, has been done since the convention assembled in this room ten years ago. I had the honor to preside on that occasion. I have not seen the opening address I delivered since that time, but I desire to say that I stand now exactly where I did then, when I declared that I was in favor of agricultural education, and agricultural colleges, and agricultural work; and when I maintained that if the schools were brought into close connection with a department of agriculture they would soon secure the respect and support of every intelligent man in this land [applause], as, I am happy to say, they have done. I am ready to join you in all intelligent endeavors for the purposes to which I have alluded, and I am more than grateful to the gentlemen who have assembled here this morning for the interest they have manifested in the call I have issued; and it is for you to see that your deliberations shall be so conducted as to have a permanent and useful influence upon the agriculture of this country.

In conclusion, I have one or two suggestions to make with regard to the organization of the convention. It seems hardly necessary for us to go through all the details of a temporary organization, and I think it best that some gentleman should move the appointment at once of

two committees. The first a committee of two or three on credentials, and the second a committee on permanent organization. I would suggest that the presiding officer for each one of the four conventions be chosen, that the burden of six or eight days may not be thrown upon one person. Those representing the agricultural colleges may select their chairman for the two days: those representing the animal interests, their chairman for two days, and so on. I merely lay this before you as a suggestion. I will now request my secretary to call the roll of States.

The roll of States was then called, and the following gentlemen responded:

California.—Hon. C. P. Berry.
Connecticut.—Prof. W. O. Atwater, T. S. Gold.
Colorado.—A. E. Blount.
District of Columbia.—W. S. Birkheimer.
Georgia.—Hon. George R. Black.
Illinois.—Profs. H. Peabody, George E. Morrow.
Indian Territory.—Allen Wright.
Kansas.—George F. Fairchild.
Maine.—Prof. M. C. Fernald.
Maryland.—Hon. J. Carroll Walsh, Allen Dodge, William H. Parker.
Massachusetts.—Prof. William Saunders, Prof. C. V. Riley, John Saul.
Minnesota.—Prof. E. D. Parker.
Mississippi.—Isaac A. Hedges.
Missouri.—Prof. P. Schwitzer.
New Jersey.—Prof. George H. Cook.
New York.—Prof. G. C. Caldwell, Prof. J. P. Roberts.
North Carolina.—Prof. Jos. A. Holmes.
Oregon.—Hon. M. C. George.
Virginia.—Professor Page, Professor Buchanan, Dr. M. G. Elzey, Daniel Ruggles.
Vermont.—George Hammond.
Wisconsin.—J. H. Warren.

A MEMBER. I move that the chairman appoint a committee of three on credentials, and a committee of three on permanent organization, and, if I could get a second, I should move that the committee on permanent organization make up its list for each of the four conventions from names to be selected by the States themselves.

The above was put in the form of a motion, and agreed to.

A MEMBER. With regard to those appointed to represent a State or college in a certain division, would they be considered as members also of this body?

The CHAIRMAN. Certainly; and they will be authorized to represent in the body whatever State they hail from. On the committee on credentials the chair appoints Messrs. Schwitzer, of Missouri, Clark, of Vermont, and Waring, of Massachusetts. The next business is the choice of a committee on permanent organization, and under the motion of the convention it will be necessary for the representatives of each State to select their own member of that committee. This committee should select a chairman for each one of the conventions, and their vice-president and secretaries. The chair would suggest that perhaps a recess of ten minutes will enable the several delegations to consult as to the selection of its member of this committee.

Mr. SCHWITZER. I move that the convention take a recess of ten minutes.

The motion was agreed to.

The convention was called to order at 12.05.

The CHAIRMAN. The chair will now call the States for the report of their representatives on the committee on permanent organization.

The roll was called and responded to as follows:

California, C. P. Berry; Connecticut, D. S. Gold; Illinois, G. E. Morrow; Maine. C. A. Gilbert; Maryland, Allen Dodge; Massachusetts, Prof. C. V. Riley; Minnesota, Edward D. Porter; Missouri, P. Schwitzer; New Jersey, Prof. George H. Cook; New York, Henry E. Alvord; North Carolina, J. A. Holmes; Vermont, George Hammond; Virginia. Dr. J. N. Page; Wisconsin, George E. Bryant; Colorado, A. E. Blount; Tennessee, Professor McBride; Indian Territory, Gov. Allen Wright.

The committee then retired for deliberation.

The CHAIRMAN. I have a communication from General Hazen, the Chief Signal Officer of the government, in which he states to me that he has requested Lieut. W. E. Berkheimer to take such part in this convention as he can properly. This is surely very kind indeed of General Hazen, for no more vital question can be discussed than that of the relations of meteorology to agriculture. I would therefore suggest that Mr. Berkheimer be requested to represent the Signal Service in the convention.

Mr. PORTER, of Minnesota. I move that he be admitted as a delegate, and, in addition to that, that he be requested to prepare a paper upon the relations of meteorology to agriculture.

The motion was agreed to.

Professor Holmes presented the report of the committee on permanent organization, as follows:

The committee on organization nominated the following officers of the Convention on: *Chairman*, Dr. Geo. B. Loring, of Massachusetts, and one vice-president from each State represented.

Secretaries.—George E. Bryant, of Wisconsin, and Henry E. Alvord, of New York.

JAS. A. HOLMES,
Secretary of Committee on Organization.

Mr. SCHWITZER. I move that the report be adopted.

The motion was agreed to.

The CHAIRMAN. The report of the committee seems to have created the necessity of the temporary presiding officer going on for a while longer. You will see by the programme that this day is set apart to the agricultural colleges and agricultural societies for the discussion of the general principles of farming, and of those questions which belong to agricultural education and the organizations of schools, colleges, and associations.

The first paper on the programme is an essay by Professor White. I understand that this gentleman is not present. Mr. Cook's paper on "Agricultural Education in New Jersey" is the next on the programme, and the convention will be glad to hear from him.

Professor Cook read the following paper:

AGRICULTURAL EDUCATION IN NEW JERSEY.

That a liberal education was needful for those who were to fill the professions of divinity, law, and medicine has been acknowledged and practiced on from the earliest ages. But it was not till recent times and the great advancement in physical and ex-

perimental science that men began to see the benefits which learning could bring to those practicing the common arts of life. And now, when this is known and acknowledged by all, there is yet a wide diversity of opinion as to how this learning shall be acquired, and how made available for the greatest number of persons. Shall it be taught in the common schools? Shall it be given by instruction in industrial schools? Or shall it be by the thorough training of young men in the highest branches of learning and science? Or shall technical schools take the place of colleges, and instruction be given only in the special lines in which their future pursuits lie?

For many departments of mechanical and manufacturing industry these questions are becoming well understood, and have been carried out in practice. At a meeting of civil, mechanical, and mining engineers held at Philadelphia during the Centennial Exposition in 1876, this subject was ably discussed. In addition to representative men from all the great branches of industry in our country, there were present able men from England, Germany, and Sweden, who took part in the discussion. It was very remarkable that, without a dissenting voice, the large number who spoke all took the ground that the proper education needed for any young man who wished the best preparation for industrial or business life, was the same as for professional life; that he must begin with a broad and liberal course of study in languages, mathematics, and philosophy, and in the principles of natural, physical, and chemical science. After that he may enter upon the study of his chosen profession in any of the technical schools which may suit his purposes, and then he can go out well prepared to enter upon practical work. A very few of the speakers thought that after the collegiate training in methods of study and research, the student would do best to go out and work in his chosen pursuit for a while, and then take up his course of technical study. The latter plan, however, was by most thought not to be adapted to the habits of our young men—to be impracticable.

It was interesting to follow the course of thought of the writers of the numerous papers read, and to see how the whole of them reached the same definite conclusions. They were all *specialists*, working in narrow, comparatively well-defined and productive lines of duty. There were men representing the great railroad interests of the country, others representing the canals. There were the managers of the immense coal and iron mines, the blast furnaces, the steel and iron manufacturers, the architects, and builders, the machinists, the men who manage and direct the power of wind, of water, of steam, of electricity, of explosives, and whatever can either replace, supplement, or make human labor more effective. They represented that division of labor which enables a man to concentrate his attention and energies upon a single subject, and to get from it results which in the old way of working were never thought of.

It is not surprising that such men should know the value of sound learning, and of broad and liberal culture, as the foundation for superior attainments in any line of special work.

While this is the case with so many departments of industry, it is not so, or at least it has not been so, with agriculturists. With them it has been the fashion to consider farming as an art, or a number of arts, all depending on practical skill, and not needing the study of any principles whatever. Some years since I visited what was called an agricultural college, where were gathered more than a hundred large boys and young men as students. They were hearty-looking, muscular fellows, but so dissimilar in size and apparent maturity, that I inquired of one of their teachers how it happened that the students were so unlike in appearance. The answer given was that probably there was not one among them who had not been at some other school, and been dismissed from it on account of inability to keep up with others in his studies. Their friends had then sent them there to learn agriculture. What a slur upon agricultural science! I am happy to say that though the institution is still going on, and is well known, it is not in our country. But something of the same spirit exists in the minds of many with us. Our agricultural colleges are besought to take boys and young men who have scarcely a knowledge of the fundamental rules of arithmetic, and know nothing of the rules of grammar and of writing the English language correctly, and to teach them the theory and practice of farming—to teach them, without preparation, the methods of study and investigation which are occupying, and which require, the full powers of the best-educated men. It is hard to make such persons understand the real difficulties of agricultural study, and the necessity for preparatory education in order to pursue it advantageously. They look upon farming as a trade, and the knowledge of it as contained in a set of rules.

But something more than this is needed, and as the objects which have occupied the farmer's attention are diminishing in number, he can see more plainly the condition and wants of those which remain. The removal of the spinning-wheel and the loom from the house has taken off many distracting cares. The making of butter and cheese in the large way, instead of by each household, takes away much drudgery and waste of time and attention. The improvement and cheapening of farm implements have rendered labor vastly more effective and shorter in duration than of old, and the facilities of communication have enabled men to pursue with profit the specialities which

best suit their tastes or circumstances. In short, it is the *division of labor* introduced into farming which is bringing it forward into the same rank with those important but simpler occupations which, by their very simplicity, have been sooner mastered and understood in their principles and carried out in practice. It is the addition of the study of physical science to the old and well-known branches of education which has given the practical efficiency to learning in modern times. There is still a vast field to work upon. How shall we proceed to work it most profitably?

The provision made by the United States Congress for the establishment of "colleges where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life," was a wise and timely one. It recognized the important fact that *colleges*, that is the highest institutions of learning, are needed to educate farmers, and that this education shall be first liberal and then practical. The men who drew this law understood the value of education and its relations to the industrial arts. The different States of the Union have received the grants under this law and applied them in the ways which their people have thought best adapted to their wants. In our State of New Jersey, the legislature appropriated the interest of the fund accruing from the government land grant to the support of teachers in the scientific department of Rutgers College in New Brunswick. This college was an old and well-established institution with a scientific school for one of its departments.

The partial endowment by the government fund has brought together more fully the classical, mathematical, and scientific studies which are necessary in any course of liberal education, and then elective studies in different branches of learning have given the practical bearing which furnishes direction and interest to the studies of aspiring young men. There are laboratories where chemical analyses are constantly going on; the astronomical observatory is open for practical observations and study; the geodetic and topographical survey of the State gives practice with study for some of its students; the geological survey of the State is constantly furnishing new illustrations of applied science; the farm of the Agricultural College has experiments constantly in progress on the cultivation and fertilization of crops and the feeding and profit of stock, and the State Agricultural Experiment Station, with a laboratory always open, is in communication with some thousands of farmers in all parts of the State. All these are the means provided for benefiting agriculture and the industrial arts.

Of the thirty-eight States in the Union, New Jersey is among the smallest, being the thirty-fifth in size, but in population it is the nineteenth, containing 1,131,116 inhabitants, one-forty-fourth of all in the United States. In wealth and capital it is the eighth. Its productive industries are very largely manufacturing and mining, while agriculture, which was formerly a leading industry, has now to take a secondary place. Not that it has grown less, but that others have outgrown it. The State has most extraordinary advantages for agriculture in its climate and soil, and in its nearness to the best markets of the country. But the manufacturing cities and towns within the State and the great cities of New York and Philadelphia on its two sides furnish attractions for both capital and labor which promise larger and quicker returns than can be obtained by the slower but safer and more certain profits of agriculture. Of capital, agriculture has $260,000,000; manufactures, $79,000,000. Of products, agriculture has yearly $42,000,000; manufactures, $170,000,000. In this state of affairs young men who are educated and desire to turn their education to the most profit, seek their first employment in other callings than farming, and this is the case with farmers' sons as much as with any others. Besides the smaller capital required in other callings, education is more highly appreciated in them and those who have it are better paid. Young men may fill our laboratories and may investigate subjects which are of the first importance to farmers, but there is no farmer who will give them better pay than they give uneducated laborers, and the young men cannot, without farms, apply their knowledge of agricultural principles to their own profit. Like prudent men they do not run in debt, but they go into the business which pays them best till they can pay for farms, and then they will return to them.

There are large portions of New Jersey, perhaps the largest part, where farming cannot be profitably carried on without the use of chemical or other commercial fertilizers. The purity of these fertilizers can only be determined by chemical analysis, and their action on crops can only be ascertained economically by faithful and carefully planned experiments. The interests involved in these fertilizers are enormously large and the savings to be effected by their judicious application are enough to turn what may have been a losing business into a profitable one. Again, the savings to be effected by consuming all the coarser fodders, instead of wasting them in heaps of refuse, are more than enough to pay the expenses of the best of our agricultural colleges. It is essential that farmers be instructed as to the real interests and importance of their own calling, and that they treat it with becoming earnestness and dignity.

To accomplish this end, and it is the greatest that now occupies the friends of agricultural improvement, more attention must be given to the investigation of those subjects which have their application in the cultivation of the soil and the increase of its products. The men for these investigations must come from our higher institutions of learning. Education has never begun with the improvement of the common schools, but always with the establishment of colleges and institutions where advanced and liberal education could be given. The history of every State contains examples of this—colleges and academies have been first established, and afterward, and sometimes very long afterward, common schools have been established. And this is both natural and reasonable. Teachers must be supplied before the scholars can be taught, and the higher institutions must be established to fit the teachers for their work. This is so plain that it hardly needs mentioning, but it has not been fairly appreciated and it has not been carried out as fully and successfully as it ought to have been. The excellence and value of the knowledge acquired in these institutions for other pursuits has been so highly appreciated that most of their graduates have been able to enter upon positions which better suited their tastes, or were more lucrative than was teaching in the schools. This has been true of all our colleges, and also of the institutions mainly devoted to instruction in higher English and scientific studies. A remarkable example is seen in the Rensselaer Polytechnic Institute, at Troy, N. Y. This institution was the first of its kind in this country, being established in 1824 by the Hon. Stephen Van Rensselaer, of Albany, and endowed in part by his family. Mr. Van Rensselaer established it to give instruction to young men in chemistry, natural philosophy, geology, mineralogy, botany, and kindred subjects, so that they might go out as lecturers and teachers to instruct farmers, mechanics, manufacturers, and others engaged in industrial occupations, to enable them to lighten the burdens of labor and to enlarge its products and profits. The institution was placed in charge of the late Prof. Amos Eaton, and it has proved an eminent success in its teaching: it is still in successful working. Its students are gathered from all parts of our land and from foreign countries. Some of the students have been college graduates, others have only received a previous high school education. Its graduates are to be found in every department of industrial life, and occupying prominent places as executive or as investigating men, and exerting a wide influence for good. A few of its graduates have engaged in teaching, but the most of them have found employment and better encouragement in other kinds of work. In its main object the institution is but partially successful.

The same experience has followed the efforts for collegiate and liberal education throughout our whole country. The institutions have been of great advantage to those who have been able to come within their influence. They have been the making of a large portion of our leading and influential men; but they have not sent out enough of the best qualified teachers.

And there are not enough such institutions, especially of those well equipped with men and appliances for teaching thoroughly what the men who are to take the lead in industrial pursuits need to learn. Such teaching is necessarily expensive; the cost of roomy buildings, of libraries, of apparatus and materials for experiment and research, of specimens for illustration and study, and most of all, of men competent to teach, to investigate, and to write, is large. It cannot be met by the fees of those who are to learn. It never has been, and it is less likely to be now, when the necessity for expensive appliances increases with the advance of physical science. Neither is it desirable that the benefits of such education should be limited to those who happen to have the means to pay the fees which would be required.

Our older colleges were established mainly through the efforts of professional men who wished to have their successors liberally educated, and their endowments were from the private funds of generous and far-sighted men. But now that liberal education is needed for industrial men as well as for those in what have been called the learned professions—when, in fact, the higher departments of all the pursuits of life need to be filled by educated men—the provision to accomplish this end must be made at the public expense. I do not mean to say that all or even the majority of men are to receive education in our institutions of higher learning, for most of them have neither the aptitude nor the ambition to do the hard studying that is required. But the institutions should be opened and easily accessible for those who give evidence that they are qualified to benefit by them. And the number to avail themselves of their teachings should be greatly increased. As teachers of advanced learning, as investigators of unsolved problems in science and in practice, as men of intelligent executive ability, they are needed everywhere.

Take for illustration the New Jersey Agricultural Experiment Station. This has been established to protect the interests of farmers, and to make investigations for them, such as are plainly of general importance, and yet such as individual effort cannot afford to work out. There are more than a million dollars' worth of chemical and other commercial fertilizers consumed by farmers in the State of New Jersey every year. These are bought on the representation of interested parties without any power to

judge whether they are what they profess to be or not. The experiment station secures fair specimens of such fertilizers as are in market, analyzes them and then calculates their value as compared with that of other fertilizers which can be bought. These analyses are printed in the form of a bulletin, and sent by mail to every farmer, dealer, or manufacturer in the State who has signified his wish to see them, and also to every newspaper in the State, or that circulates in it. The list to whom they are sent now numbers 2,000, and is constantly increasing. The cost and value of the fertilizers is, of course, first looked at by the farmer, and the poor ones are being rapidly discarded and withdrawn from market, and a great saving in cost of manure is effected. But besides this, the bulletins become educators to the farmers. They see from the analyses what constituents enter into the fertilizers, and are learning from their own experience which are of use to them and which are wasted on their soils. The growth in the intelligence of farmers in this respect is great and is constantly going on. In the feeding of animals the experiments are equally important. Chemical analysis shows what are the essential elements in the fodders which are commonly given to cattle when they are to be kept in thrifty condition. It is the custom everywhere to feed such fodders as will answer this purpose. But the farmer also has various coarse and rough products which only partially answer for the support of animals, such as straw, chaff, corn-stalks, &c. The addition to them of some small and inexpensive waste products makes them complete foods, as nutritious as the best timothy or clover hay, while their market value is much less. Near our great cities such waste or low-priced products as brewers' grains, cotton-seed meal, malt screenings, bran, &c., can be used to complete a ration which is nutritious, palatable, and economical. Last winter, while the daily ration of clover hay for a cow was worth 27 cents, the ration composed of straw, brewers' grains, cotton-seed meal, &c., could be made up for 19 cents. The cows yielded as much milk and increased in weight as much with the latter ration as with the former. And the daily saving by the mixed ration was 8 cents, or 30 per cent. on the cost of the hay.

These experiments are still in progress, but when it is remembered that there are 152,078 milch cows in the State, the magnitude of the saving which it promises to make becomes of public importance. It would amount in a year to $4,440,667, and it can be seen that the subject is well worthy the attention of scientific men, and fairly demands all the aid they can give it.

Another subject of investigation with us just now is that of ensilage, or the proper preservation and value of green fodder cut up and preserved in pits where it can be protected from the air. That it can be preserved for months in this way, and that stock of all kinds will eat it with avidity, is now well known. But whether it has all the nutritious qualities it had when first brought from the field is not so well proved. The enormous crops of Indian corn which can be grown in this way have very properly excited the interest and raised the hopes of enterprising farmers, and it is certainly teaching them to largely increase the products of their farms. There is, however, a considerable loss by fermentation of the sugar in it, and it becomes a question whether, after being preserved in this way, it is any more nutritious than the same cornstalks dried in the open air. The cattle eat it clean, which is certainly a saving over the feeding of the cornstalks dried in the common way. But if dry cornstalks can be cut and crushed so that cattle will eat the whole of them clean, it becomes a question of great theoretical and practical interest as to which method is most profitable. This question we have now in hand, but it is not yet satisfactorily answered.

The growth of sorghum and the production of sugar from it have been the subject of experiment with us the past season. The varieties to be grown and the fertilizers to be used have been tried upon the college farm satisfactorily, and the results thus ascertained, together with the trials on a manufacturing scale at the sugar-house in Cape May county, give strong confidence that this will add a new and profitable branch to our agricultural industries.

These investigations bring the scientific student directly in contact with the practical farmer. The experiment station becomes the educator of the working farmer. The dissemination of the results of well conducted experiments and analyses among farmers quickens their efforts to get the benefit of such results. The composition of the fertilizers the farmer has to buy, and the feeding value of the different foods and fodders on which he can support his stock, furnish the data from which the working farmer and his sons can calculate what plan will be most profitable for them to pursue. Such information stimulates inquiry, rewards careful and judicious enterprise, and is to-day the best teacher for the great body of workingmen that has ever been brought into the field.

The agricultural colleges are at their best and legitimate work when they are training men for the work of investigation; for determining the best methods of applying known principles for settling those which heretofore were unknown, and generally for doing work such as is for the common benefit of all classes of the community. There is need that those we have should be more liberally supported, and that there should be many more of them. The experiment station takes up the work where the agricul-

tural college leaves it, and carries it forward till its benefits are experienced and enjoyed in every household and upon every farm.

The two institutions work together admirably, and are doing well and satisfactorily that which has been so much desired by those who know of the dignity and efficiency of well-directed labor in every department of industry.

The reporter left the room during the reading of the above, and when he returned Mr. Gold was speaking. He is therefore reported only in part, as follows:

Mr. GOLD. * * * Is not there an opportunity to show that the farmer does not get such a very poor living as statistics would make it appear? Doesn't he eat an egg once in a while that he doesn't report as an agricultural product, or some other good things that go on the farmer's table, that he is accused of selling? I believe we are met together to represent the farming interest, and I would not like to see this convention allow that to go without an explanation.

Professor COOK. I agree with him entirely, and believe that our statistics should include everything. We might then hope to attract the attention of the young men—they who ought to go to farming.

Mr. BERRY. The point that discourages young men very much is the income that comes to the young men in trade, and they are likely to follow that which promises the largest income, without considering the failures in trade. The statistics should show to what extent is the farmer his own patron, how much does he draw from his own resources, what are his sales to others, what does he consume himself.

Mr. HEDGES. It seems to me that a fair rate for a man's living can be obtained by taking the population of agriculturists and charging up for their board the ordinary expenses for this and for clothing. It seems to me we might get at an approximate estimate in that way.

The PRESIDENT. The essay also dealt with certain matters which belong to the agricultural education—its objects and profits. This is a legitimate subject for discussion under the call of this convention, and the chair would be very glad to hear any remarks that can be made upon Mr. Cook's suggestions. Some of them were made with great clearness. It would seem that young men after getting their education from the colleges find no profitable use for it, and I doubt not there are gentlemen here connected with the colleges who are able to take it up and explain it.

Mr. FERNALD. I do not rise because I think I can give any explanation, but for the purpose of adding further testimony to the fact which the essay has brought out that our young men pursuing courses of study in the State colleges of agriculture and mechanic arts find larger inducements to go into some other professional calling than into the profession of agriculture because the returns are so much more immediate. Now, at the institution where I have the honor to preside, the young men find that if they pursue a course of engineering they can get immediate employment on graduating from the college, through which they have the means of paying the bills they have contracted. As civil or mechanical engineers they get liberal returns, whereas the young man who pursues a course in agriculture finds, as has been stated in the paper, that if he gets out of employment he can get only moderate returns for the labor of his hands; hence the inducement seems to be on the side—following one or the other pursuits—either of civil or mechanical engineering. I think it would be a very important service to the cause of agricultural education if this convention, or any association or party of men or body of instructors, could devise a way by which young men could be made to see that the returns from the farm

will be as ample and as enduring and as advantageous in all respects as from any other following, and that it opens up a field for whatever faculties or powers the student has. It is the difficulty under which those instructing in agricultural institutions constantly labor. They find that the young men have a tendency to go off into other callings, and this tendency exists as largely with farmers' sons as it does with the sons of any other class, and this is encouraged at home. The farmer expects his son to go into such calling as shall give him the most immediate and largest returns. I think this is true in a very large majority of cases, and if the institutions in the other States have the same experience as the institution in Maine has, I have no doubt it would be the testimony of the representatives of these institutions here that they have met with the same difficulty.

The tendency for our young men to be drawn off into other pursuits is because of the fact, as I say, that the returns are not only immediate, but they seem to be ampler. I don't know that they really are more ample, but it seems so to them. Now, in what way can we cause the young men to see that they will realize as largely and as advantageously from entering into agriculture as a profession as from any other? How shall they be induced to see this while other inducements are so strong in the other direction? This is the question, and it is an important one for this convention or any body of educators to discuss, and I wish we might have some light thrown upon it. These are the facts of my own observation. The tendency is strong from the cause I have mentioned.

Mr. ATWATER. My friend, Mr. Fernald, has commenced in a line which seems to me to lead directly toward some of the explanations and some of the answers in which we are mostly interested in this connection. He tells us that the young men come to his institution, and I know what these young men are, because I have seen them, and they are all solid men. They come there earnest and ambitious, with very little money, but with lots of good intentions and a capacity for lots of good work. By diligence, by economy, by a little money from home that comes from selling a few eggs and a few potatoes, and by borrowing a little from Uncle Henry they manage to get through college. They have a debt of, we will say, $200 that has to be paid. Now, it is just exactly as President Fernald has said. John goes out with this debt, and he remembers that there is still a mortgage of $500 on the farm, which his father has not been able to pay. Now, if he can get $60 a month in engineering, he is going there instead of on a farm for $15. Now, what is to be done? It seems to me that among the others there are two solutions of this problem. The change that has got to come about, that I believe will come about, must be a slow one, and among the other things which shall contribute to it there are two. First, show John how to make money on the farm, and how to make better use of his brains on the farm. His Uncle Henry went to the city, his father staid at home. The uncle is a lawyer, and can make plenty of money; he can afford to loan John $200. This uncle was no smarter than the father, but the uncle made his money by the use of his brains. He sees how a smart boy can go into the city and have a prosperous and successful career; he don't see that prosperity on the farm. He don't see men make a great deal of money on the farm.

Professor Cook has told us how, by the application of science, he has been able to get from his breed of cows just as much milk and just as good milk for 19 cents a day as he had been getting for 27 cents a day. He had been feeding clover hay, and had been paying 27 cents a day.

Instead of that, he has fed straw which John's father thought was not worth as much for fodder as his brewers' grain, cotton-seed, and so on.

Now, when John finds out he can go home and feed the stock to such an advantage, he at the same time will see that there is a use in which he can use his brain and make money, and have the satisfaction that always comes from the use of a man's mind. The farmer's boy has two considerations. He wants to be a man of thought, as well as a rich man. To come now to the practical application of that—what is wanted in the Maine College of Agricultural and Mechanical Art, what is wanted in the University of Tennessee, what is wanted in the Maryland colleges and oth r colleges is the solving of this question: How can we best and most successfully bring forward the movement that is necessary to show John how he can make more money on the farm than his father does; how he can use his brains more on the farm? If John can see some of these experiments going on, and see how and where the money is saved, what a valuable lesson he has learned.

Now the professor (Fernald) will pardon me if I speak of a family matter. I happen to know that in the same institution Professor Balens has been earnestly at work to make experiments of a most valuable character. I have seen him at work. Now, why hasn't Professor Balens made more? He has not the money. He was only able to make that particular experiment last season and the season before by aid of a contribution from a benevolent gentleman, outside of the State, of money to pay for the fertilizers used in the experiment. It is such experiments that John ought to see, and he would very soon come to know how he could make more money on the farm, and use his brains more. The moral of this, it seems to me, is too evident to require further talk.

Mr. ALVORD, of New York, thought one point had been overlooked. The openings for young graduates were rapidly increasing, and it should be understood that every year there are positions upon salaries for young men who have prepared themselves in colleges as instructors or managers of large estates.

Mr. SARGENT, of California, said that young men from colleges in the East who went West to the Pacific slope encountered a condition of things different from anything they had been led to anticipate. He referred to the arid region of California, Utah, Nevada, and Arizona, some portions of which did not have more than two or three inches of rain a year. He desired to know if it was not possible to teach some of the young men who go out there, whether or not there are certain plants which thrive with a slight degree of moisture; whether those plants which need no water have not an economical value there, and if there are not other plants of similar characteristics that may be made valuable? Again, young men should be impressed with the fact that the constant production of wheat, without rotation, is exhausting our soils, and pouring its richness into the sewers of London and Paris.

Mr. SCHWITZER had no doubt that if the results obtained by agricultural colleges in 20 years could be tabulated, it would be found that they had been educating farmers' sons away from the farm. Ours is mainly a country of small farms. The small farmer raises the staples, and it is the business of the agricultural colleges to see to it that he understands how to obtain better returns. One of the causes is to give these young men a liberal education, and upon that a technical education. It is then only a question of dollars and cents. He didn't wish to say anything against the highest education possible, but the small

farmer should bebenefited. Limit the education to a certain course, and the young man would go back to the farm.

Mr. GOLD, of Connecticut, was happy to say that there was established in Connecticut last year, through the liberality of a private individual, who gave a farm of 170 acres, an agricultural school, expressly for the purpose of educating boys that come from the farm, on that farm, and for the farm. They are daily exercised in all the methods of the farm in addition to the studies of the class-room. Boys from the common schools of the State are received. We hope from this small beginning that there will be a multiplication of such institutions in every State, where boys can be educated on the farm, and for the farm.

The delegate from California thought the technical education should not be given before the liberal, and that a system of compulsory work should be adopted. If the work was made voluntary on the student he would soon loose his respect for it.

Mr. FERNALD, of Maine, thought one other point had a bearing upon this matter. When the institution was started it was difficult to obtain professors of agriculture. "Just in proportion as the Department of Agriculture in the institution is made prominent, in just that proportion will the young men be attracted toward it." Just as soon as they see an opportunity for returns, and a field for their powers, they will go into agriculture as readily as in any other pursuit. Draw them into the department and maintain their interest there. Give them charge of experiments under the supervision of a competent instructor.

Professor COOK, of the New Jersey Agricultural College, heartily approved the working of the agricultural experiment stations, and cited cases to prove the necessity for such stations, both in determining the wants of different crops for special kinds of fertilizers, and also the peculiar action which characterizes different soils in regard to the same fertilizer. He considered the work of the experiment station, where the investigations in the laboratory are joined to and proved by experiments in the field, to be the first which has fully met the wants of the practical farmer and the demands of improved agriculture. And further, he had found that the immediate and wide publication of the practical results reached by the stations was an admirable method of teaching farmers the principles of their art. Such stations quicken inquiry among farmers, stimulate them to exercise their skill and intelligence in pursuing their business, and give them the assurance that science applied to agriculture brings as sure and as large returns as it does in any other department of industrial life. With these additions to the practical working of our agricultural colleges the young men who graduate from them may safely be left to choose such industrial pursuits as best suit their means or tastes. Agriculture will certainly claim and receive its full proportion of them.

Professor ROBERTS, of New York, stated that his experience had been different from those who had preceded him; he had no difficulty in persuading students at Cornell to return to the farm; no difficulty in finding places for those who wanted to work on salary when they were properly prepared.

Mr. HEDGES, of Missouri, stated that he had just returned from the South, and in opposition to Horace Greeley's advice to "Go West," he should advise all young graduates to go South; that there they would find good salaries and pleasant occupation.

Dr. ELZEY, of Virginia. I have had some experience in agricultural colleges as a teacher. I agree with Mr. Fernald, of Maine, that the agricultural department of the institutions should be made more prom-

inent. I have had considerable experience in the State of Virginia where the agricultural department has been hitched on as an adjunct to the University, and which has had the result of educating men in the wrong way; if the young men were not educated as engineers they would not follow that profession after graduating. Put the agricultural department to the front, not in the rear. His experience in Virginia was that the agricultural department was subservient to even the military. Young men should be taught to advance agricultural science. If you cannot teach him how to cultivate his land without reducing its natural fertility, agricultural science is a failure. Develop the feature of agricultural advancement first, and attach the university feature afterwards if necessary. Educate a man so that when you put him down in any part of the country he will be able to say what system of agriculture will succeed in that section, his knowledge being based upon the science which enables him to work at the system which shall pay him a reasonable profit without robbing the owner of the land by taking from the soil its natural fertilities. Dr. Elzey dwelt at length upon his experience in the agricultural college of Virginia, and stated that the question as to where plants obtained their nitrogen had never yet been answered in any of the agricultural colleges.

Mr. FERNALD, of Maine, said that there were many stations that were endowed by the act of 1862, working upon the nitrogen problem; that the endowment was for State colleges of "agriculture and mechanic arts;" that the whole needs to be looked after, otherwise they fail to carry out the purposes for which they were founded. He would not have it understood that graduates of the colleges pursuing a course upon agriculture turned out engineers, for they did not.

Mr. BUCHANAN, in reply to Dr. Elzey, said that, in his opinion, the college of Virginia was doing well and good work, and that his experience led him to differ from the views which Dr. Elzey had expressed.

Dr. ELZEY desired to correct any misapprehension relative to his remarks upon the condition of the agricultural college of Virginia, and wished to say that since Mr. Buchanan had been at its head its status had very much improved.

Professor CALDWELL, of Cornell, desired to say that he thought the agricultural colleges have been guilty to a large extent of all the accusations that had been made against them. They had departed widely from the purposes for which they were originally created. The trouble had been that the right kind of men could not be found to conduct agricultural colleges. Students studied law because they can get more money by being lawyers, and engineering for the same reason. Until the same thing proves to be true, by experience, in the case of agricultural colleges, this will continue to exist; until farmers' sons see that young men who graduate as agriculturists are more successful they will not go and do likewise.

The PRESIDENT. The chair desires to say that any gentleman who was present at the last convention held in this room and is here to-day must see the immense progress that has been made in agricultural education since that time. Some of the strongest men in the country engaged in the debate on that occasion, but it was evident that few of them comprehended its true value and importance. Since that day a great change has taken place. I see now no reason for any discouragement. I presume there never was a college that did not have some period in its existence in which its fate appeared to be somewhat doubtful. But no doubt should now remain with regard to that business interest for which the students of agricultural colleges are educated. As a profit-

able occupation it is now recognized. I have always said that there is no such thing as unprofitable agriculture in the hands of an honest, faithful, intelligent farmer. The earth has never yet failed to respond to a wise and proper demand. There are mistakes in farming, to be sure, as there are in other branches of business; but you take the community generally, and you will find that agriculture is as uniformly profitable and yields as generous returns as most of its associate industries. True, there may not be so many individual instances in the East, but there are in the West, farmers who would not exchange their farms for any business within their grasp. I visited, last autumn, some of the extensive farms in Illinois, Iowa, and Wisconsin, and I looked upon the agricultural enterprises of these various States as one who never had an idea of our eastern industries would look upon the great manufactories of Lowell, or Waltham, or Lawrence. Some of these farms are as imposing in all their business proportions and as encouraging to all the economies of State as are these great mills to which I allude. Nor is this the only section where I have had the pleasure of witnessing the growing, progressive, advancing agricultural enterprises of the country. I desire to bear my testimony to what I have seen in the South. I perceive there, a manifest desire to leave those things that are behind, and to press forward to those that are before. The gentleman from South Carolina (Mr. Aiken), who is present, knows very well that everywhere in his own State, and other States of his section, there are evidences of advancing steps in the way of diversified and profitable agriculture. The great cattle interest in the West is as sure a mode of profit as is any well organized commercial interest. What better evidence than these can one have of the success which is sure to follow the application of the sturdy common sense of an agricultural community to the business of farming.

As I come East I see another system adopted with sound judgment and enterprise—a system which will ultimately extend throughout this country. It is the cultivation of special products devoted to local markets. Many an acre of land in the vicinity of our large cities is said on good authority to yield a thousand dollars annually. In my own neighborhood in Massachusetts there is land that pays the cultivator $250 and $300 per acre every year. You may see there good farmhouses and barns, the people cultivating their minds, accumulating libraries, and in every way striving to learn their duties as American citizens, and their obligations to the community and State in which they live. There is in the business of practical American farming the basis of our best civilization, the best intelligence, and a broad and enlightened state policy which is not equaled anywhere on the face of the earth. [Applause.]

Now, if we have proved that our farming communities stand so high among those of the rest of the world, you may ask what is the necessity of agricultural science? For myself, I think the necessity for accurate endeavor is in proportion to the value of the occupation. Hence it is that we of all people need the aid of science in order that we may teach those laws of farming which shall make both the general and special agriculture to which I have alluded more systematically and accurately carried on.

Now, when I am told that young men who graduate from these colleges avoid agriculture and adopt engineering as a profession the reason at once suggests itself. It is much easier to graduate an engineer than it is a farmer. Every man knows that if he were running a rail-

road he would find it easier to secure an engineer for his road, or mechanic for his machine shop, than would his neighbor, who owns a thousand acres in Virginia, to find a man to organize his force and manage his land. You can graduate lawyers who will carry you through all the intricate windings of the courts, or physicians who are renowned for their skill, but when you come down to this business of agriculture and would find a man whom you are willing to employ as an expert you are involved in difficulty at once. And yet there is no want of liberal compensation in this calling. Give me one hundred good horticulturists, competent to arrange vineyards in California or market gardens near New York or Boston, or to adapt themselves to the various systems of farming with their knowledge of the several branches of agriculture and horticultnre, give me one hundred such men, and they can find employment at once. There is an abundance of it everywhere. The demand for such is greater than the supply. I have hardly known an instance where the owner of a large estate could go to a college and assure himself that he could find there a man qualified in every way for his purposes. Take moreover the business of veterinary surgery. There are investigators here who have for a long time been struggling to solve certain questions relating to the application of that science, and in every step they have made thus far they have felt the need of a strong, powerful, educated veterinary corps to take these matters in hand. We have them, to be sure, in individuals, but they have hardly yet established themselves in this country as a strong body of scientific investigators, whose opinion is accepted as law. Give us a corps of veterinary surgeons, graduated from the agricultural colleges of this land, and let us see how long it would be before their services would be in demand.

The same thing applies to market gardening. There are those who, by their ingenuity and skill, are equipping themselves for that profitable industry; an industry whose growth has been so rapid that its importance and value can hardly be estimated.

It becomes each year more and more necessary that we should know how we can better manage and utilize our labor. Teach your young men those things which shall enable them to present themselves properly to the owners of large estates, and there will be no further fault found with reference to their immediate employment. Teach your young men how to keep the buildings in good order; how to select and breed and feed their cattle; how to systematize the whole business of farming. There are no people so imitative as farmers; none who watch their neighbors so closely, criticising the affairs of adjoining farms while taking care of their own; none who estimate more highly the value of good example. There is no reason why young men should be discouraged, or why teachers should be discouraged as to the effect produced upon students by the teachings of these colleges. President Garfield used to tell a capital story of a cultivated and intelligent and practical gentleman who, when asked what benefit he had ever derived from his knowledge of Latin, replied: "Perhaps no special benefit from the Latin itself, but I have derived some benefit from the fact that I once knew it so that I might forget it." The agricultural colleges can infuse a degree of enthusiasm and love of practical science into the minds of active and vigorous men, by placing before them the agricultural problems of the day, which will produce an immense effect upon the agriculture of this country, and which will tell throughout this whole land.

You will excuse me for making these remarks, but I desired to say

something that would remove every suspicion that the agricultural colleges are a failure.

The colleges can succeed; they do succeed; and I insist that they will be a source of immense benefit to this country in coming generations.

I have never heard a better discussion upon agricultural education than I have heard this morning. It is suggested that there is now to be read a paper that will possibly take up what has been alluded to, and if it be the pleasure of the convention it will now be read.

Mr. PEABODY. Such a paper will naturally involve considerable discussion, and I am disposed to move an adjournment unless there be some other matters of a temporary nature to be taken up.

The PRESIDENT. Are there any suggestions as to the hour to which we shall adjourn?

Mr. PEABODY. That is a matter which I shall leave to the gentlemen or chairman.

The PRESIDENT. We will probably have three or four essays to dispose of before the end of two days. I am perfectly willing to leave it to the convention.

Mr. HEDGES. I move that we adjourn until half past seven this evening.

The motion was not agreed to.

The convention then, on motion, adjourned, at 3.48, until 10 o'clock to-morrow morning.

JANUARY 11, 1882.

The convention was called to order at 10.20 o'clock a. m.

The CHAIRMAN. If any delegates have arrived since yesterday's meeting, I would request them to register their names at once in the book provided for that purpose. I would request them, in addition to giving their names, to give their addresses, as the others have. It is not necessary, in a deliberative body like this, to submit the proceedings of the previous day. It is merely a record of what was said, and cannot possibly be submitted. I desire to say to the convention that the hours for deliberation will be from 10 o'clock to 1, and from 2 to 5. This will give the members an opportunity for lunch at 1 o'clock. I think, in that way, the convention can be more systematically arranged. I will state that there has been a request made that a resolution should be offered limiting debate to ten minutes. For myself, I somewhat object to this, as the discussion consists largely of papers, and prefer very much to leave it to the good sense of the members of the convention what time each one should occupy in discussing a paper. I know many gentlemen, in discussing great subjects like these, which would be subject to a vote, want more than the ten minutes suggested, and ought to have it. I am perfectly willing, as presiding officer of this convention, to leave to the judgment of each member how long he shall talk, or what he shall have to say. The paper that will be read this morning will be as upon the programme—the paper by Professor Caldwell upon "Experimental stations as an educator of the farmer." That will be followed by another paper by Professor Atwater upon "Co-operative experiments." Before Professor Caldwell reads his paper, I have a communication to lay before you from Mr. Blackburn, of the committee of the National Fair Association—an important association—on whose grounds I rather expect and hope, at least, that some large

national agricultural fair will gather at some future day. They have excellent arrangements there, and I am sure that the grounds will be interesting to many gentlemen present.

WASHINGTON, D. C., *Jan.* 11, 1882.

DEAR SIR: On behalf of the National Fair Association, I most respectfully request you to invite the delegates now in attendance at the National Agricultural Convention to visit the National Fair Grounds, at such time as may suit the convenience of the convention.

Very respectfully,

H. H. BLACKBURN,
Committee, National Hotel.

Hon. GEO. B. LORING.

I have stated to Mr. Blackburn that we had better wait until fair weather. You will have to leave by the Baltimore and Ohio road at twelve o'clock. It is only ten-minutes' ride from the city. I will request the delegates to give their names and the titles to any papers proposed to be offered that they may be arranged in the programme. The paper now to be read will be a paper by Professor Caldwell, upon Experimental stations.

THE EXPERIMENT STATION AS THE EDUCATOR OF THE FARMER.

BY PROF. G. C. CALDWELL, *Cornell University, Ithaca, N. Y.*

We are told that the first experiment station in Germany had its origin in a craving of the farmers of a certain part of the country for more knowledge; its establishment came about in this way: In the year 1845, in a petition addressed to the Saxon Government by Friedrich Ludwig Riessner, and others, attention is called to the change in agricultural opinion since the sagacious chemist, Liebig, entered the field of agricultural chemistry with his investigations—to the ready reception given to his new ideas all over the civilized world—and to the evidently wide-spread feeling that chemistry should be made more useful to agriculture than had hitherto been the case, and to the importance of the continuance of these investigations for the elevation of agriculture, and the consequent improvement in the general welfare of the country; great stress is laid on the value of the better acquaintance with the soil that may be gained by the study of its chemistry, and of the application of chemistry to the examination of manures, and especially of the artificial manures which must come into use if the productive power of their soils is to be maintained; observing that since the introduction of the use of bones into England for manure the yield of her acres had been doubled, attention is called to the folly of exporting bones and oil-cake to that country, and sending to the South Sea Islands for guano; the eagerness of the English farmer is shown to make use of all the aid that chemistry can give him, notwithstanding the large crops that he is already getting, and as evidence of this it is stated that two agricultural societies, one in England, the Royal, and the other in Scotland, the Highland and Agricultural, have since two years employed chemists, whose sole work it is to give advice to the members of the respective societies, and to make analyses of soils and manures for them, and that even Liebig has been called to England several times for advice. It is therefore petitioned that for each circuit district an able young chemist shall be appointed by the state, to be called the agricultural circuit chemist; it shall be his duty to attend all the agricultural meetings of his district, to give the aid of his scientific knowledge, and at the same time to add to his own practical knowledge of agriculture; to give lectures at suitable times and places to farmers on agricultural chemistry; to analyze soils, manures, &c., whenever called upon to do so; from time to time to travel through his circuit for the purpose of informing himself as to the condition of the agriculture of every part of it, of giving chemical counsel and instruction, and of interesting the farmers in agricultural experimentation for themselves. The petition was not granted, on the ground that the mass of the farmers of the state were too ignorant to derive much benefit from such an establisment; they would need to be instructed how to make use of it to their advantage; but, at the same time, it was generally believed by intelligent and scientific men that under the right conditions, circuit chemists, performing such work for agriculture, might accomplish very much for its advancement. As the result, however, of the agitation of public opinion which the very general discussion of the petition produced, Adolph Stockhardt was appointed professor of agricultural chemistry in the Academy of Agri-

culture and Forestry at Tharand, in Saxony, and on the erection of a new academy building a well appointed laboratory was provided for the new professor. His duties were to consist in part in giving popular lectures on agricultural chemistry at meetings of farmers' clubs, in performing, so far as his time would permit, such analytical work as might be sent to him by farmers through the minister of the interior, and in conducting experiments for the advancement of agricultural science. The agricultural papers of the time, as well as the excellent little agricultural-chemical journal which he himself conducted for a period of several years, testify to the zeal with which he entered into this work, and give evidence of the important part which he took in the rapid progress made by agricultural chemistry at this period, when Liebig was also devoting a large share of his energies to this branch of the science in whose every department he has made himself so eminent. But the facilities for field experimentation at the academy were inadequate; application was made to one of the most prominent agriculturists of the state for aid in securing something better for the purpose, the final result of which was the establishment of the first experiment station in Germany, largely through this gentleman's liberality, on a portion of his own estate at Möeckern.

Baron Liebig, a thoroughly scientific man and an enthusiastic investigator in chemistry, brought his knowledge, enthusiasm, and experimental skill to bear on the application of his favorite science to a practical art, in which, perhaps, more than in any other industry, there has been a mere following of old ruts, and consequently scanty progress for many generations; a new light broke in upon the old art, and the desire to see and get the benefit of this new light was the first beginning of the stirring up of public opinion, which ended with the first agricultural experiment station. You are not unacquainted with the rapid growth of this idea, peculiar, I believe, to agriculture, of special institutions whose main and in many cases sole object is the scientific investigation of questions arising in or concerned with its practice, for the purpose of improving that practice; you know that from that seed planted in 1851, at Möckern, in a very unpretentious way, with the now famous Emil Wolff as director to nurture it, on the modest salary of 300 thalers, or about $225, a most vigorous plant has grown up in Germany, and that the seed has been carried from that country to every other country where agricultural progress is a matter of any importance to the welfare of the people. Almost every year since 1851 has witnessed the establishment of one or more experiment stations in Germany or elsewhere, and we find them now in Italy, Switzerland, Austria, Russia, Sweden, Norway, Denmark, Holland, Belgium, France, Spain, Great Britain, and the United States; and not only do we see every branch of agriculture represented, even to wine production, olive culture, and silk culture, but other practical arts have taken up the idea, and we have experimental stations for beer brewing, and for the manufacture of spirits and of sugar. It is the duty of the scientific men, gathered at these stations, in some cases, to deliver popular lectures on their sciences to the farmers of the neighborhood, thus carrying out the idea that was prominent at the time that the first station was established; and working as these men are all the time on problems in whose solution the farmer has a peculiar interest, there is no doubt that where these lectures are well given and well listened to, they may do much for the improvement of the farmer's practice; but it is not of this kind of education proceeding from the experiment station that I wish to speak now, but of the less direct and really wider influence, which may be just as active and potent, whether the men who are doing the work of the stations ever leave their workshops or not, to teach the farmers whose interests they are laboring to advance.

In 1876, the twenty-fifth anniversary of the establishment of the first station at Möckern, was celebrated at that place by a gathering of agricultural chemists and others interested, and the publication of a special volume of the *Versuchs-Stationen*, a journal now twenty-seven years old, and devoted exclusively to the work of the stations. Only to give the bare titles of the papers, more than 2,000 in number that have originated at these stations in the first twenty-five years of their existence, takes 145 pages of this volume; these papers treat of original researches on the atmosphere, water, and soil, in their relations to the growth of plants; the physiology of plants, embracing everything relating to the conditions of their growth; the diseases of plants and all the enemies that attack them; the chemical composition of all kinds of agricultural plants, and at different stages of growth; the chemical composition of manures of all kinds; experiments with manures of all kinds, and on all kinds of crops; the composition of the domestic animals and their secretions, including milk; the composition of fodders and foods; the preparation and preservation of fodder; the digestion and digestibility of fodders; the production of various kinds of animals in meat, milk, wool, &c.; silk culture, forestry, the manufacture of wine and beer, and sugar, milk, butter, and cheese, and analytical methods in agricultural chemistry.

Such had been the work of the stations up to that time six years; and with a hundred stations at work now, it can well be believed that a busy man hardly has time to keep track of all the progress made in this one department alone, even if all his study lies in that direction.

To the German or the French farmer a large part of this new material has been directly accessible, for many of these articles were published not in abstruse scientific journals but in the agricultural papers; and each Experiment Station has in many instances published its own special annual report of the work of the year, which was doubtless freely circulated in its own immediate neighborhood, just as the annual reports of our own stations in Connecticut, New Jersey, and elsewhere are widely circulated in their respective States.

Thus each station becomes, by its published work, an important educational force in its own neighborhood or province; even though but one farmer in ten, more enterprising and more eager for new information than his neighbors, may read these reports with any care, yet as surely as he gets anything good from them and uses it to improve his own practice his neighbors will find it out and profit by it. No farmer can hide his light under a bushel, but his works are like a candle set on a hill, and all around him can learn lessons from his good or ill success. Furthermore, all this mass of new material, the work of the investigators at the Experiment Stations, has furnished a motive and a basis for much writing of books on agriculture, in which the results of the agricultural researches made in different parts of the world are brought together in their proper connection with one another, the wheat is screened from the chaff, and the practical bearings more plainly set forth; and in such compilations much greater force can often be given to the lessons taught by the cumulative evidence of concordant results obtained at different stations.

Such excellent works as Johnson's "How Crops Grow," and "How Crops Feed," so good as to have been considered worthy of translation and publication in Germany, which seems like carrying coals to Newcastle, and Armsby's "Manual of Cattle Feeding" are based in the one case largely and in the other almost entirely on the results of Experiment-Station work, and neither would have been written but for that material at the disposal of the authors.

Of similar works in Germany and France there are many more; and from the number of them, and the new editions that are in some cases called for, it is evident that the books are read even more than in this country. Of the means for education in this manner, derived primarily from the Experiment Station, there is no lack in any country where advanced agriculture is practiced; the lack is rather in the zeal with which they are used by those for whose particular benefit all this work is done. Again, the agricultural press is getting to make use more and more of both the older and the fresher results of Experiment-Station work for the edification of its readers. Whose contributions are more eagerly sought for by our leading agricultural papers just now than those of Mr. Lawes, of England, the founder and steady supporter for more than thirty years of an experiment station, older and more productive of valuable practical results than any other station in the world? And what does he write about but the results, many of the greatest value, because they have been accumulating during so many years, of his own Experiment Station. He has the fortunate gift of writing well as well as of investigating well, which gives to his teachings double force. How ready these same papers are to give up whole columns at a time to the publication of a series of results obtained at one of our own Experiment Stations, even if it be nothing more than the chemical composition of a number of commercial fertilizers in the market—information that is useful enough in its way, but much less so than what might be furnished from such sources if the Stations were supplied with means for doing something else besides analyzing fertilizers.

It appears plain that the Agricultural Experiment Station is a permanent institution in every agricultural country of importance; that it has already in a comparatively short time given us great accessions to our knowledge of the principles of agriculture, and that there are many channels of communication between the stations and the community whose welfare their work should improve. Does the farmer need that all this costly work shall be done in his behalf, and does he realize his need? If not, then he will not be educated by it. There are farmers who neither know nor care to know of anything better than the ways their fathers have trod before them; they are to be found in all parts of the country, and in larger proportions where the general standard of education is low, or else occupying those broad acres in the West, slowly but surely growing less and less broad, where farming consists in nothing but plowing skin deep, sowing the seed and reaping the harvest; but it is not in such regions that the few experiment stations in this country are located. Connecticut, New Jersey, New York, and North Carolina are not tilled by ignorant farmers, and their soils respond liberally only to intelligent and liberal treatment. An observing resident of New England said to me the other day that the farms there are gradually passing into the hands of men who bring some degree of intelligence and thought to bear on their work, and that those who simply follow the old methods and care nothing for new ideas are forced either to give up and go off or else to fall in line with their more progressive neighbors; the progressive farmer, the man who is ready to study new ideas, and to put them in practice so far as his circumstances will allow, is getting the upper hand just in proportion as the soil becomes worn out and exhausted

by the careless or senseless treatment; the progressive farmer is the hope of every country where agriculture demands intelligence, and he is now the hope of the greater part of our country.

No one would deny that every such farmer knows his need of the Experiment Station, and knows that he can reap advantage from it. He may not accept as gospel all that comes from there; he may be and often is quite skeptical as to the value of the results obtained with indoor water culture or pot culture and chemical analyses; he may even sometimes go so far as to indorse such an expression of opinion as this, coming from an agricultural paper published in Central New York; speaking of the plans for the organization of the new Experiment Station of that State, its editor says: "The farmers of the State will be satisfied with nothing short of an experimental farm managed by men with ears to hear their questions and capability and willingness to answer them in a practical way before the questioner's eyes on the farm; not a mere Station with a chemical laboratory where a few scientists with fat salaries can pursue their studies and amuse themselves with their visionary schemes and pet theories of farming, as valuable to the average farmer as to the man in the moon, and no more applicable to the broad acres of the Empire State than to the sunken valleys of that opaque body." The editor gives evidence in such remarks that he has a better knowledge of astronomy than of an Experiment Station; but still there are those, even in some sense progressive farmers, who will heartily approve such an effusion; fortunately for the State, however, as I happen to know, the newly appointed Director of the Station will not entirely exclude the chemist, who, everywhere else in the world where there is such an institution is looked upon as its mainstay; he is already in search of one, and means that he shall have a fair salary and a fair laboratory too. But let the progressive farmer be critical, and often even skeptical; he should be critical, or he would not be worthy to be called progressive; if only he is not satisfied with the things of the past, nor even with the things of the present, but is ever striving after something better than either, the Experiment Station can draw encouragement and support from him, and he will learn in turn from the Experiment Station itself, even if it has a "chemist on a fat salary" of a thousand or fifteen hundred dollars.

Webster defines an experiment to be "an act or operation designed to discover some unknown truth, principle, or effect, or to establish it when discovered;" and he goes on to say that it differs from observation, which is merely the attentive consideration of things as they exist in nature. An experiment requires that something shall be done to bring certain objects into certain new relations to each other; the result may be a positive or a negative one; there may be a new effect or there may not be one; but whether there is or not the result may be just as important for practical purposes. If by a long and careful series of experiments it is shown that nitrogen in the fertilizers applied to corn produces no increase in the crop that is proportionate to the expenditure, the result is an important one to agriculture, for it may save the farmer, who will put himself in the way to learn the lessons which the Experiment Station may teach him, from paying 15 to 50 cents a pound for that expensive ingredient of commercial manures, to be put on a crop that will give him no profitable return for his investment.

An agricultural experiment is made for the purpose of learning something new about the production of crops, or milk, or meat, or wool; but such experiments were made long before Experiment Stations were established. Our entire present system of agriculture is based as much on the result of experiments as the present science of chemistry, which is considered eminently as an experimental science; is built up on the results of experiments in the laboratory; our improved methods of culture, our improved varieties of grain, fruit, potatoes, roots, &c., represent the accumulated experience of many years, and of thousands of experimenters in all parts of the world; our present stage of agricultural development has been reached by laborious experimentation, and if we are to go any further, and develop any more, we must continue to experiment. The Agricultural Experiment Station is established, as its name implies, expressly for agricultural experimentation; it is simply a new force put at the disposal of the farmer, in the direct line of all the progress in his art which has hitherto been made: it is not a new way of making advance in agriculture, but a strengthening of the old way, by setting apart men who are trained in the art of experimenting, who can devote their whole time to the work, instead of merely such scanty leisure as comes to the farmer.

Much, if not most, of the experimenting that has been done outside of the special institutions created for the purpose, has been prompted by pecuniary motives. In this way new varieties of plants and breeds of animals have been developed, and new methods of manufacturing agricultural products. This kind of experimentation will go on and yield useful results as heretofore; but there is a vast quantity of work of a kind that gives no direct pecuniary return whatever to those who do it, whose results are of at least as great pecuniary importance to agriculture as when the work is done for its direct profits, and, because there is no pecuniary return, and the necessary ex-

pense is sometimes serious, few farmers are able to undertake such work. A few years ago, wishing particularly to test a question raised by interesting experiments at the Massachusetts Agricultural College as to the effect on the proportion of sugar in fruits produced by potash salts as a fertilizer, I proposed to the members of a large and intelligent horticultural society of my own State, that if they would conduct certain experiments of the kind, according to a common plan laid out by me, I would analyze, without charge, such fertilizers as they might wish to buy and test. Hardly one responded; but the excuse was, and I saw that it was a good one, that they had no time for the details of the experiment—to look after them themselves. Just when they should be giving their attention to these details, they were crowded with work that must be done at the time. If farmers could experiment in the winter, when their fields are hardened by frost or buried in snow, they might find it a pleasant occupation for the leisure hours of that season; but all the burden of the care of field experiments comes just when the burden of regular work is greatest.

The case, in short, is just this, then: Agriculture cannot stand still any more than can any other practical art. It must share in the general spirit of progress that rules the age. This progress depends on continued experimentation—much of it of a difficult and expensive character. The Experiment Station is created and provided with men, means, and appliances especially adapted to the work. Without a public that is ready to appreciate and understand its results, to be educated by them, and to put them into practice, it has no use in being. There is such a public waiting to receive and wisely use these results—waiting and willing to be educated by the Experiment Station. If there is not, the idea of progress in agriculture is nothing but a dream: and these institutions, lacking the encouragement that is absolutely essential to their existence, would have ceased long ago to exist, instead of spreading far and wide from their birthplace in Germany, or, perhaps more truly, on the farm of Mr. Lawes, in England, and increasing steadily in numbers from the beginning.

In order that the Station shall educate, and the farmer be educated, a certain attitude of each toward the other is essential. There must be, in the first place, mutual respect and confidence. The workers at the Station must give due consideration to the experience of the workers at the plow—an experience that is by no means to count for nothing in its bearings on the Experiment Station results.

On the other hand, the farmers must give due weight to the accuracy which especially characterizes their methods as distinguished from the necessarily rougher methods of the field and the common barn, and the more accurate reasoning that can be based on such results. Take, for instance, the question whether plants can feed on the free nitrogen of the atmosphere. Some people argue that because there is such a great abundance of nitrogen in the atmosphere that bathes the plant through its whole life, and because some crops can somehow get nitrogen in abundance where others cannot, therefore certain plants, at least, if not all, can make direct use of the free nitrogen of the atmosphere. Two most careful sets of experiments, by investigators known all the world over for their skill, accuracy, and honesty, have shown very conclusively that when a plant is put where it can get only a limited quantity of combined nitrogen from the soil in which it grows, besides an unlimited quantity of free nitrogen supplied in a constant stream of washed air passing over it, it can use only the combined nitrogen, and can make no use of the free nitrogen. I am aware that another series of investigations appears to have given the opposite result; but those who are acquainted with the full history of this series are little inclined to have faith in its results. Furthermore, no less an authority than Mr. Lawes has shown, by chemical analysis of the soils of some of his experimental plots, at different periods extending over many years, that when any crops, even such as appear to get their nitrogen from the air, are not supplied with manure, the quantity of combined nitrogen in the soil is surely diminished. It has, moreover, been shown again and again that every arable soil contains a quantity of combined nitrogen many hundred times greater than what is supplied in a liberal dressing of manure, which, however, is so difficultly assimilable that ordinarily remunerative crops cannot be made on that nitrogen alone. Yet, in spite of all these well-established facts, there are those who write for the agricultural papers, in a style which leads one to suppose that they consider themselves fitted to be teachers of men who almost scout the idea that the plant should go anywhere else than to the atmosphere for its nitrogen. To the merely superficial observer, it seems most natural that the plant should feed on atmospheric nitrogen, no matter whether free or combined. This belief that it does is founded on *nothing whatever* but this superficial observation; but this kind of observation is far more likely to lead to error than to truth. A fair degree of confidence in the results of careful scientific work would lead some of these writers to place less reliance on what is only apparently so clear and plain to them, but is contrary to the results of scientific research.

In the second place, each party should seek to acquaint itself as fully as possible with whatever truth the other has learned, whether by experience or by experiment. In a paper recently read before the London Farmers' Club, Voelcker says: "It is absolutely necessary that in conducting agricultural experiments the experimenter him-

self should not merely be a good chemist, but must have also a fair and sound knowledge of farming operations, and have gained considerable insight into the requirements of practical agriculture. Such knowledge, you will agree with me, cannot be obtained from books or lectures, but by taking a personal interest in, and daily going through, the routine work of a well-conducted farm. I have no hesitation that the absence of this essential groundwork has frequently been the cause of the failure of many experiments, and of the misleading and contradictory results which you cannot but have observed in not a few of the published records of field trials."

I can say nothing more forcible on that side of the question, and on the other little need be said, for I think that the progressive farmer, whom alone we can expect to be directly educated through the instrumentality of the Experiment Station, is ready to consider whatever comes in his way from the Station. It might only be said, perhaps, that he should go a little more out of his way than he now does to study the work of the Stations. Let him study it as critically as he will, in the light of his own common sense and practical experience, but fairly and with all due allowances for the manifold difficulties of the work. These difficulties are often too lightly thought of. Concerning this point, Voelcker says in the paper just noticed: "An agricultural experiment, to be worth recording at all, is, as I hope to show in the course of this address, no easy matter. Indeed, I may say, without fear of contradiction, that I do not know of any kind of experimental inquiry more difficult in carrying out rationally and successfully." I could give quotations from the writings of all who have undertaken agricultural experimentation, whether in the field or in the barn, expressing the same decisive opinion. To him who undertakes only a single experiment on one or on many points it does not appear to be so difficult a matter; for he nearly always gets an answer, and a decided one, either positive or negative, to his question. But every one who is accustomed to trying experiments knows that the result of a single one is, till confirmed by repetition, entirely insufficient for the "establishment of a new truth, principle, or effect;" and as soon as one begins in accordance with scientific methods, the only methods by which trustworthy knowledge is to be gained, to repeat his experiments he falls in line with others who have followed this method, and pronounces it difficult. It needs only a few trials of confirmatory tests, with one answer to the question put in the experiment, yes; another, no; and a third neither yes nor no, to convince any man that the way of the agricultural experimenter is hard; nor does it, on the other hand, need many trials with three or four or more results confirming each other to give him that peculiar confidence in the knowledge gained which every scientific student feels in the soundness of a principle which he has once established by proper methods.

The agricultural Experiment Station originated in a desire of the farmers for a better acquaintance with the principles underlying their life-occupation; the rapid and wide extension of the system gives evidence that it has met a widely-felt want; its faithful and busy workers have already produced an abundance of material for the farmer to test in his practice; and if neither teacher nor pupil be too wise in his own conceit, and each is fully appreciative of the worth of the other's possessions in his own field of labor there need be no fear but that this peculiar institution will become in every land where it takes root and thrives a most efficient means of improving the success, and consequently the condition, of the agricultural community."

That it shall do so in this country is certainly the sincere wish of every one who hears me; that it will do so is, I am sure, an article of your faith, as it is of my own.

The CHAIRMAN. Before the reading of the next paper by Professor Atwater, I have a communication which is so appropriate to the admirable paper just read, that I desire it to be placed before the convention.

WASHINGTON, D. C., *January* 10, 1882.

The Hon. GEORGE B. LORING,
Commissioner of Agriculture:

SIR: We understand that it has long been a matter of regret to the enlightened friends of scientific agriculture in this country that the department over which you preside is not possessed of an adjunct which, in Europe, is deemed an indispensable auxiliary to agricultural industry in all its branches, whether that industry be considered in its national or in its local relations.

We refer to those "stations" which, in Germany, under the name of *Versuchs-Stationen*, and, in France, under the name of *Stationen-agronomiques*, have been established for the purpose of making analyses of soils, of water, of manures, and of provender for cattle, as also for the purpose of instituting experiments in the acclimation of trees, plants, and vegetables, in connection with researches which look to the prevention or cure of the special diseases to which the products of the vegetable kingdom are liable.

We believe that the first "experiment station," created in the interest of public economy, was established in Germany, at Möckern, near Leipsic, in the year 1851, but the number of such establishments has so largely increased that the agriculture of nearly every important district of Germany may now be said to have its "station" devoted to the prosecution of such researches as have for their object the promotion of the special agricultural interests which shall be found best adapted to the soil and climate of each region.

And you are aware that these "experiment stations" have proved so fruitful of beneficent results that a periodical publication, devoted exclusively to the report of the investigations and discoveries made under their auspices, has been supported in Germany since the year 1859, until, at length, it has become a recognized authority for agricultural chemists, for students of vegetable or animal physiology, and, indeed, for all persons desiring the latest scientific intelligence in matters pertaining to husbandry.

Understanding that you are desirous of establishing, in connection with the Agricultural Department at Washington, an "experiment station" similar to those which have been found so advantageous in Europe, we beg leave, respectfully, to invite your attention to a tract of land which we believe to be peculiarly eligible for the purposes in question, whether regard be had to convenience of access, to the quality of its soil, or to the configuration of its area.

We refer to the "Trinidad estate," situated on the northeast boundary of Washington, in the immediate vicinity of the Columbia Institution for Deaf Mutes, at Kendall Green, and comprising an extent of 152 acres, which are believed to be ample for a preliminary essay in this direction.

The estate belongs to the Columbian University, and is held in trust by that institution with a view to its sale or rent, that by the proceeds from such sale or rent it may give a new impulse to the scientific and technical instruction which will hereafter form a part of the curriculum, so soon as its new university buildings shall have been erected in this city.

The farm will be conveyed to the Agricultural Department, by sale or lease, on terms satisfactory to the government.

Believing that the proposition we make has a two-fold advantage, that of contributing directly to the wants of the Agricultural Department, and to the cause of scientific education in this city, we beg leave to invite for it your careful consideration.

All which is respectfully submitted on behalf of the Columbian University.

W. W. CORCORAN, *President.*

ROBERT C. FOX, *Secretary.*

This communication, which I have received from Mr. Corcoran, I propose to lay before the Speaker to be submitted to the House of Representatives; and I propose to send with it such papers as are read here before this convention, in order that Congress may understand, fully and thoroughly, what the whole business means. I have a paper in my possession which has been prepared by Mr. Saunders, superintendent of the horticultural division of the department, a very admirable document, which I shall inclose, and which, if we have time, shall ask Mr. Saunders to read. These papers were prepared before the opening of the convention, and have no relation whatever to it. They happen to come in properly, however, and I think appropriately. Professor Atwater will now read the paper upon co-operative experiments.

Professor ATWATER. I am very happy to know that the paper which I have to read, and the remarks that I have to make, come in the connection in which they do, for it certainly seems to me that it is in a measure, if not in continuation, and in accord with the statements of the admirable paper to which we have listened. The particular object of this paper is to invite the attention of this meeting to the usefulness of studying certain of the great problems of fertilization and plant growth by co-operative experiments; by experiments which shall be made at experimental stations and by the agricultural colleges; by intelligent, capable, and able farmers; and it gives me great pleasure to have an opportunity to read a paper on this occasion, from the fact that I see before me quite a considerable number of gentlemen representing those institutions, who have been engaged or are engaged in precisely the experiments to which I shall call their attention:

CO-OPERATIVE EXPERIMENTING AS A MEANS OF STUDYING THE EFFECTS OF FERTILIZERS AND THE FEEDING CAPACITIES OF PLANTS.

By Prof. W. O. Atwater.

Farmers from Canada to Texas are spending millions upon millions of dollars every year for guano, fish scrap, ammoniated superphosphates, nitrate of soda, and the like. Ostensibly, they are buying the fertilizers at from $20 to $100 per ton. Actually they are buying nitrogen at from 15 to 40 cents per pound. But need the farmer spend so much for nitrogen? Or might he use more with profit? These are questions that no professor of agriculture can answer. Indeed, no chemist or botanist to-day can so much as tell him how the different plants he cultivates stand related to nitrogen, for what ones he must buy it, and what ones he may use in his rotation to gather it from nature's stores and furnish it to him without money and without price save the cost of tillage.

The question of the nitrogen supply is only one of a great many whose solution is most urgently demanded. We must know how to feed our plants, or go without food ourselves. We need more light. Some must come from the laboratory and the greenhouse; some must be sought in the field.

Field experiments rationally planned, carefully carried out, faithfully reported, and interpreted with the aid of the most advanced science, will carry us far toward finding out many of these things which we so much want to know. If, along with these, we can have proper studies, chemical and physical, of the soils experimented upon, analyses of the plants produced, and in addition pot experiments whose conditions can be definitely known and controlled, and especially if we can work together, we may hope for the information we need.

Five years ago, while director of the Connecticut Agricultural Experiment Station, I suggested some field experiments with fertilizers to be carried out by farmers for the purpose of studying the needs of their soils and the best materials to supply them. The outgrowth of these, in the form of extended series of experiments during four successive seasons, has been stated briefly in the American Agriculturist, and, in more detail, in the reports of the Connecticut Board of Agriculture for 1877, 1878, 1879, and 1880. The experiments of 1881 have not yet been published in detail, but a few of the more important results will be given herewith.

With the sets of experimental fertilizers were sent blanks on which any who should choose were invited to send reports of their experiments. Nearly three hundred experiments have been reported. They come from colleges, experiment stations, and individual farmers in all the States east, and from some west of the Mississippi, and from several of the British provinces. The quality of the work as indicated by the reports is most gratifying.

The experiments have been of two classes. The first, which may be called general experiments, are of a simpler sort, and intended primarily for soil tests, involve the use of eight or more different kinds and mixtures of fertilizing materials containing nitrogen, phosphoric acid, and potash. The second class, the "special nitrogen experiments," have been of more complicated character, and have had for their object the study of the feeding capacities of some of our more common cultivated plants, with special reference to the nitrogen supply.

It is to these latter experiments that attention is especially invited here.

THE FEEDING CAPACITIES OF PLANTS.

The experiments we are discussing bring us face to face with one of the most important problems with which agricultural chemistry has to deal, and at the same time throw some new light upon it. I refer to what may, perhaps, be most properly called the feeding capacities of plants, their power of gathering their supplies of food from soil and air, and the effects of the artificial supply of different ingredients of plant-food upon their growth.

A vast deal of experience in the laboratory and in the field bears concurrent testimony to the fact, though we are still deplorably in the dark as to how or why it is so, that different kinds of plants have different capacities for making use of the stores of food that soil and air contain. Of the ingredients of plant-food in our soils, the most important, because the most costly, is nitrogen. Leguminous crops, like clover, do somehow or other gather a good supply of nitrogen where cereals, such as wheat, barley, rye, and oats would half starve for lack of it, and this in the face of the fact that leguminous plants contain a great deal of nitrogen, and cereals relatively little. Hence a heavy nitrogenous manuring may pay well for wheat and be in large part lost on clover.

NEED OF MORE INFORMATION.

Hitherto we have been compelled to rely mainly upon European investigations for our facts regarding the nutrition of plants and the action of manures. Our information is incomplete, and even the foremost teachers may give us wrong counsel.

Dr. J. B. Lawes, of Rothamsted, England, unquestionably the foremost field experimenter in the world, in writing, in 1873, to the treasurer of the Massachusetts Society for the Promotion of Agriculture, said: "The best possible manure for all graminaceous crops—wheat, barley, maize (corn), oats, sugar-cane, rice, and pasture grass—is a mixture of superphosphate and nitrate of soda. * * * Potash is generally found in sufficient quantities in soils, and the artificial supply is not required." In more than half of our experiments with corn, and in nearly all with potatoes, the crops have been materially aided by potash salts, and without potash in the fertilizer they have often failed. The mixture which Dr. Lawes regards as "the best possible manure" for corn was sometimes very useful and sometimes brought almost no return. The potash, which his experience in England led him to consider superfluous, was here, in many cases, the most necessary of all the fertilizing ingredients.

Several years ago the professor of agriculture of one of our leading agricultural colleges proposed a series of formulas for different crops. With the rest was one for corn, which, with a moderate proportion of potash and a small amount of phosphoric acid, supplied nitrogen at the rate of 64 pounds, and at a cost of over $15 per acre. Later, a well-known writer upon agricultural science has enthusiastically advocated the culture of corn with chemicals, recommending for the purpose, and using in an extensive series of experiments upon his own farm, a fertilizer which supplied nitrogen at the rate of 90 pounds, and at a cost of $18 to $20 per acre. Both of these gentlemen thus assumed that to raise corn successfully would require large and costly supplies of nitrogen. The question whether corn can gather its own nitrogen, like clover, or demands an artificial supply, like wheat, whether it is an "exhausting" or a "renovating" crop, has been much discussed. Upon its answer depends the success of corn-growing in our older States. The experiments referred to bear emphatic testimony upon this point. The corn has almost uniformly refused to respond to nitrogen in fertilizers, and persists in getting on well without any artificial supply. But it has been largely benefited by phosphoric acid, and often by potash. The formulas above, with their large and excessively expensive amounts of nitrogen, would, in nearly every case, have involved great waste of both fertilizer and money.

EXPERIMENTS UPON THE EFFECTS OF NITROGENOUS FERTILIZERS.

One of the ways in which co-operative field experiments may aid in the solution of these problems may be illustrated by citing some of the details of the series of experiments upon the effect of nitrogen in fertilizers which were referred to above, and which have been performed by a number of professors in agricultural colleges and practical farmers, with what seems to me with most gratifying success.

The specific questions to be studied may be stated thus:

1st. How do the plants experimented with get on with the "mineral" fertilizers, such as are supplied by superphosphates and potash salts?

2d. More especially, how do they respond to nitrogen when added, in different forms and amounts, to the mineral fertilizers?

3d. And, finally, what inferences may we draw as to the feeding capacities of the plants, their power to gather their food from soil and air, and the effects of different materials upon their growth, especial reference being made to the nitrogen supply?

To the systematic study of these questions a special "nitrogen experiment" was devised in 1878, and conducted by several gentlemen. Similar series were repeated in 1879, and with some variations in 1880 and 1881.

The idea was to compare the effects of mineral fertilizers (superphosphate and potash salts) alone, and the same with nitrogen in different amounts and forms. The plan is explained in the following extract from a circular sent to the experimenters:

The object of this experiment is to test the effects of nitrogenous fertilizers in different amounts and combinations upon the growth of the plant, and inferentially its capacity to gather its nitrogen from natural sources.

The fertilizers.—The ingredients and amounts are such as are used in ordinary practice, phosphoric acid and potash being supplied in about the proportions that occur in a corn crop of fifty or sixty bushels, and nitrogen in one-third, two-thirds, and full amount in same crop.

Forms of nitrogen.—The nitrogen is supplied as nitric acid in nitrate of soda; as ammonia in sulphate of ammonia, and as organic nitrogen in dried blood.

Quantities of nitrogen.—The nitrogen is supplied at the rate of twenty-four pounds per acre in "one-third ration"; forty-eight pounds per acre in "two-thirds ration"; and seventy-two pounds per acre in "full ration."

Arrangement of plots and fertilizers.—The ingredients are supplied as—

Partial fertilizers { Group I. Nos. 1—3. each by itself. / Group II. Nos. 4—6. Two by two. } Thus testing the effects of ingredients separately, and capacity of soil.

Complete fertilizers { Group III. Nos. 7—9. Nitrogen as nitric acid in nitrate of soda. / Group IV. Nos. 10—12. Nitrogen as ammonia in sulphate of ammonia. / Group V. Nos. 13—15. Nitrogen as organic nitrogen in dried blood. } Nitrogen in one-third, two-thirds, full ration.

The fertilizers were supplied, in part at cost, and in part gratuitously, by the Mapes Formula and Peruvian Guano Company of New York. Especial thanks are due to Mr. C. V. Mapes, without whose interest and enthusiasm, as well as counsel and substantial help, the enterprise could not have succeeded as it has.

The full details of the experiments are to appear in a report of the United States Department of Agriculture. The tables herewith give an outline of results of some of the experiments of the last season and will serve as illustrations. The figures are, however, much condensed, and many interesting details are omitted.

TABLE I gives the results of several experiments with cotton, corn, and potatoes. The unfavorable weather which affected the majority of the experiments has reduced the yield materially in most of these. In several the effects of unevenness of soil are manifest; on some the supply of available plant food in the soil was evidently so great as to obscure the action of the fertilizers. Those of Mr. Newton with corn, and Mr. Manning with clover, show marked exceptions to what seems to be the common rule, that these crops are not greatly aided by nitrogenous fertilizers. Indeed, all illustrate forcibly our need of more experimenting.

TABLE II shows an experiment on an older and slightly different schedule. It is interesting both because of its sharply defined results and as an illustration of the excellent work ordinary farmers do in this line.

TABLE I. NITROGEN EXPERIMENTS, 1881.

I. PROF. W. C. STUBBS, Alabama Agricultural and Mechanical College, Auburn, Ala.
Soil—Worn-out pasture; level, upland, sandy, light, well-drained. *Subsoil*—Red dish yellow clay. *Weather*—Dry and unfavorable.

II. EDWARD HICKS, Old Westbury, N. Y.:
Soil—Level, sandy loam, light, dry. *Subsoil*—Yellow loam. *Previous crop*—Corn. *Weather*—Dry and unfavorable.

III. PROF. C. L. INGERSOLL, Purdue University, La Fayette, Ind.:
Soil—Upland, level, black, similar to prairie, sticky when wet, bakes when dry; dry, well drained. *Subsoil*—Gravel. *Previous crop*—Corn. *Weather*—Very dry and unfavorable.

IV PROF. SAMUEL JOHNSON, Michigan Agricultural College, Lansing, Mich.:
Soil—Level, upland, sandy loam, light, drained dry. *Subsoil*—Gravelly. *Previous crop*—Corn. *Weather*—Dry, cold, unfavorable.

V. W. C. NEWTON, Durham, Conn.:
Soil—Old meadow, hill land, dark loam. *Subsoil*—Moist. *Weather*—Unfavorable.

VI. J. W. PIERCE, West Millbury, Mass.:
Soil—Worn out grass land, upland, nearly level, clay loam, light, dry. *Subsoil*—Gravelly, but some clay. *Weather*—Cold and unfavorable.

VII. C. E. THORNE, farm manager, Ohio State University, Columbus, Ohio:
Soil—Level, upland, clayey loam, "drift formation" from Huron shale, compact, wet before draining. *Subsoil*—Similar to surface soil, retentive. *Previous crop*—Corn, with stable manure. *Weather*—Severe drouth.

VIII. J. M. MANNING, Taunton, Mass.:
Soil—Upland, sandy loam, loose. *Subsoil*—Yellow sand. *Previous crops*—Potatoes and corn. *Weather*—Unfavorable.

Table I.—Effects of Nitrogenous Fertilizers.

I. Professor Stubbs, Alabama, Cotton.
II. Mr. Hicks, New York, Corn.
III. Professor Ingersoll, Indiana, Corn.
IV. Professor Johnson, Michigan, Corn.
V. Mr. Newton, Connecticut, Corn.
VI. Mr. Pierce, Massachusetts, Corn.
VII. Mr. Thorne, Ohio, Corn.
VIII. Mr. Manning, Massachusetts, Clover.

Fertilizers and produce per acre.

	Number of experiment.	I. Cotton.	II. Corn.	III. Corn.	IV. Corn.	V. Corn.	VI. Corn.	VII. Corn.	VIII. Clover.
		Lbs.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Lbs.*
	0. No manure	587	16.3	38.2	44.7	12.5	10.3	40.0	480
Preliminary Group	1. Nitrate of soda, 150 pounds	805	26.0	35.9	53.1	22.5	11.7	44.3	700
	2. Superphosphate, 300 pounds	1,162	22.8	36.4	51.2	13.8	16.0	48.6	1,200
	3. Muriate of potash, 150 pounds	564	34.5	34.5	52.0	15.0	17.7	48.6	940
	4. Nitrate of soda, 150 pounds / Superphosphate, 300 pounds	1,599	24.5	33.6	61.6	23.8	14.3	50.3	1,080
	5. Nitrate of soda, 150 pounds / Muriate of potash, 150 pounds	932	29.5	34.5	43.6	23.8	23.0	44.9	560
	6. Superphosphate, 300 pounds / Muriate potash, 150 pounds } mixed mineral fertilizers	1,219	28.2	34.5	59.0	13.8	34.6	52.	1,140
Nitrate of soda Group	7. Mixed mineral fertilizers (as No. 6) / Nitrate of soda, 150 pounds	1,541	29.0	37.3	58.8	23.3	34.0	49.1	1,200
	8. Mixed mineral fertilizers / Nitrate of soda, 300 pounds	1,404	33.8	32.5	55.6	41.7	35.7	45.7	1,460
	9. Mixed mineral fertilizers / Nitrate of soda, 450 pounds	1,242	31.5	33.1	49.1	56.7	41.4	47.4	1,480
	6a. Mixed mineral fertilizers (as No. 6)	3,115	30.0	33.4	56.7	16.3	37.7	46.0	1,660
Sulphate of ammonia Group	10. Mixed mineral fertilizers / Sulphate of ammonia	1,116	27.8	36.1	55.7	28.5	39.4	41.7	1,880
	11. Mixed mineral fertilizers / Sulphate of ammonia	1,265	30.8	38.4	58.9	42.5	40.3	42.3	2,000
	12. Mixed mineral fertilizers / Sulphate of ammonia	1,162	32.5	34.0	50.4	48.3	39.4	43.4	2,400
	6b. Mixed mineral fertilizers (as No. 6)	.....	29.0	35.7	51.0	.....	28.6	48.3	1,440
Dried blood Group	13. Mixed mineral fertilizers / Dried blood, 225 pounds	1,357	37.6	34.0	49.4	28.8	35.4	41.1	1,620
	14. Mixed mineral fertilizers / Dried blood, 450 pounds	1,300	36.3	34.5	51.6	33.8	37.0	41.4	1,940
	15. Mixed minerals (as No. 6) / Dried blood, 675 pounds	1,127	35.2	33.4	61.4	40.6	39.0	39.4	2,420
	6c. Mixed minerals (as No. 6)	.....	39.7	33.4	57.1	20.6	.....	40.9	1,200
	16. Farm manure	.....	.....	.....	.....	.....	.....	43.7	1,500
	00. No manure	449	16.5	33.1	31.7	13.8	.....	35.4	800

In Professor Stubbs's experiment three plots, not mentioned in the table, had "mixed minerals" with cotton seed meal in quantities to supply nitrogen in the same amounts as in the nitrate of soda, sulphate of ammonia, &c. The yields were, with ½ ration 1,253.5 pounds, with ⅞ ration 1,548 pounds, and with full ration, 1,345 pounds per acre.

TABLE II.—EFFECTS OF NITROGENOUS FERTILIZERS.

Experiments with oats and potatoes in 1881. *By Mr. Charles Fairchild, of Middletown, Conn.*

[Soil, dark loam, loam subsoil, moist ; had oats in 1877, rye in 1878, grass in 1879, and corn fertilized as below in 1880.]

	Kind and amount of fertilizers per acre.	Yield per acre.			Increase per acre.			Cost of fertilizers, freight, &c.	Pecuniary results.			
		Oats.		Potatoes.	Oats.		Potatoes.		Value of increase.		Gain.	
		Grain.	Straw.		Grain.	Straw.			Oats.	Potatoes.	Oats.	Potatoes.
		Bush.	*Lbs.*	*Bush.*	*Bush.*	*Lbs.*	*Bush.*					
0	No manure	26. 9	1, 180	28. 0								
1	Nitrogen mixture, 150 pounds	38. 1	1, 820	42. 0	11. 3	627	13. 3	$6 00	$9 75	$9 98	$3 95	$3 98
2	Superphosphate, 300 pounds	33. 8	1, 800	56. 0	6. 9	607	27. 3	6 00	7 42	20 48	1 42	14 48
3	Muriate of potash, 150 pounds	31. 3	1, 720	60. 0	4. 4	527	31. 3	3 75	5 50	23 48	1 75	19 73
4	Nitrogen mixture, 150 pounds, and superphosphate, 300 pounds	51. 9	2, 660	94. 7	25. 0	1, 467	66. 0	12 00	22 55	49 50	10 55	37 50
5	Nitrogen mixture, 150 pounds, and muriate of potash, 150 pounds	42. 5	2, 160	68. 0	15. 6	967	39. 3	9 75	14 40	29 48	4 65	19 73
6	Superphosphate, 300 pounds, and mur. of pot., 150 pounds, "mixed minerals"	33. 8	2, 280	90. 7	6. 9	1, 087	62. 0	9 75	10 30	46 50	55	36 75
7	Mixed minerals (as No. 6), 450 pounds, and nitrate of soda, 150 pounds	54. 4	3, 500	124. 7	27. 5	2, 307	96. 0	15 75	28 97	72 00	13 22	54 25
8	Mixed minerals, 450 pounds, and nitrate of soda, 300 pounds	59. 4	3, 860	138. 7	32. 5	2, 667	110. 0	21 75	33 88	82 50	12 13	60 75
9	Mixed minerals, 450 pounds, and nitrate of soda, 450 pounds	59. 4	4, 380	120. 0	32. 5	3, 107	91. 3	27 75	36 52	68 40	8 77	40 65
6a	Mixed minerals (as No. 6), 450 pounds	36. 3	1, 760	94. 0	9. 4	567	65. 3	9 75	8 56	48 98	1 19	39 23
00	No manure	27. 5	1, 280	46. 7								
10	Mixed minerals, 450 pounds, and nitrogen mixture, 150 pounds	51. 9	3, 140	122. 7	25. 0	1, 947	94. 0	15 75	25 43	70 50	9 68	54 75
11	Mixed minerals, 450 pounds, and nitrogen mixture, 300 pounds	55. 6	3, 380	144. 7	28. 8	2, 187	116. 0	21 75	28 93	87 00	7 10	65 25
12	Mixed minerals, 450 pounds, and nitrogen mixture, 450 pounds	59. 4	3, 780	144. 7	32. 5	2, 587	116. 0	27 75	33 40	87 00	5 65	59 25
6b	Mixed minerals (as No. 6), 450 pounds	33. 8	1, 760	110. 0	6. 9	567	81. 3	9 75	7 18	60 98	2 57	51 23
13	Mixed minerals, 450 pounds, and sulphate of ammonia, 225 pounds	61. 9	3, 700	135. 3	35. 0	2, 507	106. 6	21 75	34 29	79 95	12 54	58 20
14	Mixed minerals, 450 pounds, and dried blood, 450 pounds	53. 8	3, 080	134. 7	26. 9	1, 887	106. 0	21 75	26 10	79 50	4 35	57 75
15	Peruvian guano, 450 pounds, and muriate of potash, 150 pounds	54. 4	2, 980	133. 3	27. 5	1, 787	104. 6	21 75	25 85	78 45	4 10	56 70
16	Mixed minerals (as No. 6), 450 pounds	35. 0	1, 760	96. 0	8. 1	567	67. 3	9 75	7 87	50 48	1 88	40 73
000	No manure	26. 3	1, 120	29. 3								
A	Bone, 150 pounds	31. 3	1, 680	54. 0	4. 4	487	25 3	3 00	5 33	18 98	2 33	15 98
B	Bone, 150 pounds, and muriate of potash, 100 pounds	35. 0	1, 960	74. 0	8. 1	767	45. 3	5 50	9 07	33 98	4 57	28 48
C	Same as B, and sulphate of ammonia, 100 pounds	45. 6	1, 980		18. 8	787		10 75	15 03		4 28	

The plots were parallel strips of eight square rods each. In 1880 corn was planted over the whole field. In 1881 the whole was divided into halves by a line crossing the plots, and one-half devoted to oats and the other half to potatoes. Mr. Fairchild proposes to follow with wheat and grass, thus running the experiment through a regular rotation of several years, the same fertilizers being applied to the same plots year after year, while the crops succeed each other, as in ordinary farm practice. The cost of the fertilizers includes $5 per ton for freight and applying. Potatoes are estimated at 75 cents per bushel, oats at 55 cents, and oat straw at $12 per ton, which are fair rates for the region and season.

The variety of results in the different experiments is very striking. Mr. W. I. Bartholomew, of Putnam, Conn., has been conducting the nitrogen experiments with corn and potatoes for three years. In every trial every plot which has received phosphoric acid has given a more or less satisfactory return, and every one without phosphoric acid has failed. Nitrogen and potash have each increased the yield of corn, but neither has brought enough increase to pay its cost, and the loss has been larger or smaller as more or less was used. Potatoes, on the other hand, have responded profitably to all the ingredients.

Mr. C. Sage, of Middletown, Conn., has had a very different experience. Nitrogen has proved as inefficient on his land as on Mr. Bartholomew's. Phosphoric acid, which Mr. Bartholomew finds so effective, helps him but little, while potash is decidedly the regulating ingredient, the corn responding uniformly and largely to every application of potash salt. One hundred and fifty pounds per acre of muriate of potash, costing $3.50, makes the difference between corn so poor as to be hardly worth the husking, and 60 bushels or more of beautiful shelled corn and a fine growth of stalks.

In the experiment of Mr. C. Newton, of Durham, Conn., given in Table I, we have a still different result. Potash is as useless as in Mr. Bartholomew's experiment. Phosphoric acid does no more good here than with Mr. Sage. But the nitrogen to which both these gentlemen's corn paid so little heed is on Mr. Newton's soil uniformly efficient. The corn responds largely and profitably to nitrogen in every form and on every plot, and the yield rises and falls regularly with the amount of nitrogen applied; I should add that in each of these cases the results are those not of a single, but of two or three years' trials. Mr. Newton's experience, however, seems to be an exception and an unusual one. Instances in which the nitrogen is absolutely harmful are much more frequent. Professor Thorne's in Table I is such an one. The corn here suffered from very severe drought, but Professor Thorne writes me that he has observed the same thing in favorable seasons, and several other reports tell the same story. Mr. J. W. Sanborn, the well-known farm superintendent and experimenter of the New Hampshire Agricultural College, has a case in which sulphate of ammonia helped the corn materially the first season, did no good the second, and "utterly demoralized" it the third.

On soils that are rich, or even in fairly good condition, nitrogenous fertilizers, like other manures, often show very little effect. Such seems to be the case in Professor Henry's experiment in Table I.

EFFECTS OF NITROGENOUS FERTILIZERS UPON CORN.

Estimating a bushel of corn, with its cobs and stalks, to contain 1½ of nitrogen, and to be worth 80 cents, the effects of the nitrogenous fertilizers in the special and in the general experiments may be summarized as follows, remembering that the superphosphate and potash salt, "mixed minerals," supplied the amounts of phosphoric acid and potash in a crop of not far from 55 or 60 bushels, which would also contain about the 72 pounds of nitrogen

In the general experiments of the mixture of 300 pounds superphosphate and 200 pounds muriate of potash brought on the average of fifty-three experiments, about 43½ bushels of shelled corn per acre. The special experiments, however, seem to me a fairer test of what the fertilizers may do, because, while made in all sorts of weather and on worn-out soils, they were nearly all on soils and in latitudes fit for corn, as many of the general experiments were not. In these the mixture of 300 pounds superphosphate and 150 pounds of potash salt, which can be bought for $8.25, brought, on the average, 43 bushels of shelled corn per acre. Omitting Mr. Newton's experiment, the results of which are very exceptional, the average is 44½ bushels.

The experiments of the four seasons bear almost unanimous testimony to two things: The corn was helped but little by nitrogen in the fertilizers; and it gathered a good deal from natural sources. The increase of crop and of nitrogen in the crop will appear more clearly if we look at it another way.

In number of trials—	With nitrogen.		The average increase of corn was—	The increase of nitrogen in the crop was.
	Amount per acre.	Contained in crop of—		
	Pounds.	*Bushels.*	*Bushels.*	*Pounds.*
95	24	18	3.6	4.8
76	48	36	5.3	7.1
42	72	54	6.6	8.8

Or, estimating the results in dollars and cents:

In trials, total number.	With nitrogen, amounts.	Costing.	The nitrogen paid for itself in trials.	The nitrogen failed to pay for itself in trials.	The average loss in the several trials was.
95	24 lbs.	$5 50	21	74	$2 62
76	48 lbs.	11 00	13	63	6 76
42	72 lbs.	16 50	4	38	11 22

The only cases in which the largest rations were profitable were in the experiments of Mr. Newton.

The above calculations of pecuniary loss and gain of course apply only to those regions where corn is dear. But even at these rates the nitrogen increased the crop enough to pay its costs in only 38 trials out of 213. The pecuniary loss rose and fell with the amount of nitrogen used. With mineral fertilizers alone the crop gathered, by the above estimates, some 60 pounds of nitrogen per acre.

The important fact, however, is this: The corn plant has in these trials shown itself capable of getting on and bringing fair yields with small amounts of the less costly mineral fertilizers, even in the worn-out soils of the Eastern States. With this help it has gathered its nitrogen from natural sources, and holds it readily to be fed out on the farm and returned in the form of manure for other crops. In other words, the experiments thus far imply that corn has, somehow or other, the power to gather a great deal of nitrogen from soil or air, or both; that in this respect it comes nearer to the legumes than the cereals; that, in short, corn may be classed with the "renovating" crops. If this is really so, and this can be settled only by continued experimenting, then our great cereal, instead of being simply a consumer of the fertility of our soils, may be used as agent for their restoration.

FEEDING CAPACITIES OF OTHER CROPS.

The results of the experiments with other crops were briefly summarized in an account given in the last report of the Connecticut board of agriculture, as follows:

"Taking all in all, the potatoes responded well to the superphosphate, the potash salt, and the nitrogenous fertilizers, and the 'complete fertilizer' has been most profitable in almost every case where the weather permitted fair growth. None of the other crops, except, perhaps, turnips, have shown such uniformly beneficial results from all the materials.

"The experiments indicate very decidedly that the potato plant differs from many others in respect to the effect of these fertilizing materials upon its growth, and imply that it has less capacity than corn for gathering an adequate supply of food from natural sources. It seems to demand a full and immediately available supply of nourishment for its successful growth.

"Concerning the other crops, the data at hand are too meager to warrant any general conclusions. * * * In general, however, the experiments accord with the common notion that makes superphosphate almost a specific for turnips. But they imply that even when the superphosphate is supplied in abundance, the turnip is not usually able to gather enough of the other materials for a full yield unless they are close at hand in readily available forms."

EXPERIMENTS WITH COTTON.

Professor Stubbs' experiment with cotton is extremely interesting. Phosphoric acid has great, and potash very little, effect. Nitrogen increases the crop, but that in cotton-seed meal is as useful, or more so, than in the other and more costly materials, nitrate of soda, sulphate of ammonia, and dried blood. This is only one of a number of experiments which Professor Stubbs has made, upon whose results, added to his general experience, he bases a number of important conclusions, among which are the following:

"1. Our [Alabama] soils, which result from the disintegration of metamorphic rocks, principally feldspathic and hornblendic, need a little nitrogen, much phosphoric acid, and no potash for cotton.

"2. Our great want, and it seems to prevail through the older cotton States (except the black cretaceous belt of Alabama, which has not been thoroughly tested), is soluble phosphoric acid. On worn-out soils a small amount of nitrogen is required. A fertilizer with 3 per cent. of nitrogen and 10 per cent. of soluble phosphoric acid, meets the demand very well.

"3. Phosphoric acid hastens and nitrogen retards the maturity of the crop.

"4. Cotton seed and cotton-seed meal are as effective as dried blood, sulphate of ammonia, nitrate of soda, or other nitrogenous fertilizers, and far cheaper and more economical."

To what extent and under what conditions such principles as these are applicable in the culture of cotton and other crops, are matters of vital importance in Southern agriculture. The usefulness of systematic experiments to test them needs no argument

EFFECTS OF PHOSPHORIC ACID IN DIFFERENT FORMS OF COMBINATION.

The nitrogen supply is only one of the many questions whose solution is of vital importance to our agriculture. The relations of phosphoric acid, potash, and other ingredients of plant food, whose lack in our soils we seek to supply, at great expense, with phosphates and potash salts, demand equally full and thorough study.

Treating the insoluble phosphate of bone or mineral phosphate with acid to make superphosphate is expensive. Soluble phosphoric acid costs us from 12 to 15 cents or more per pound, while we can buy it in the insoluble forms for from 4 to 6 or 7 cents. The general theory is that superphosphate is necessary, but still, somehow or other, many of us have the feeling that, in many cases at least, the cheaper insoluble phosphates would do as well; that fine grinding might serve instead of superphosphating; and that there are many cases in which the cheap rock phosphates might replace the dearer bone manure. If so, the saving would be immense.

The Aberdeenshire Agricultural Association of Scotland, through Mr. Thomas Jamieson, F. C. S., its chemist, has been for several years past conducting an extended system of experiments in which have been studied, with other things, the effects of phosphoric fertilizers of different sorts, alone and associated with nitrogen.

The results of several years' work on five typical varieties of Aberdeen soil in the ordinary state of cultivation are summarized by Mr. Jamieson in the statements.

"1. That phosphates of lime decidedly increase the turnip crop, but that farmers need not trouble themselves to know whether they are of animal or mineral origin.

"2. That soluble phosphate is not superior to insoluble phosphate to the extent that is generally supposed.

"3. That nitrogenous manures have little effect on turnips used alone, but when used with insoluble phosphates increase the crop; that the addition of nitrogen to soluble phosphates does not seem to increase the solid or dry matter in the crop; that there is no material difference between the effects of equal quantities of nitrogen in nitrate of soda and in sulphate of ammonia.

"4. That fineness of division seems nearly as effective in assisting the braird and increasing the crop as the addition of nitrogenous manures. Hence the most economical phosphoric manure for turnips is probably insoluble phosphate of lime, from any source, ground down to an impalpable powder."

Mr. G. Clendon, jr., of Buckner's Station, Va., who has carried out a series of the "general" experiments above referred to, and taken the opportunity to test finely-ground South Carolina phosphate alongside the dissolved bone-black, obtained with the raw phosphate a yield larger than with superphosphate or stable manure, and nearly as large as with the complete fertilizer. The testimony of a single experiment, of course, must always be questioned; but Mr. Clendon's results have the regularity that characterizes uniform land, and seem to be borne out by other experiments and his general experience. He writes:

"My experiments have been carried on over ten years. In every year the good effect of the raw phosphate was apparent. * * * The soil is a decomposed gneiss, uniformly poor, and is a fair sample of hundreds of square miles lying between the base of the Blue Ridge and tide-water in Virginia. * * * I think the experiments should be repeated over a wider country."

On the other hand, it is a familiar fact that in the neighborhood of Charleston, S. C., where the raw phosphate is obtained, its use in the raw state has not become general, and that many attempts elsewhere to introduce insoluble phosphates have failed. When, where, and why the different forms of phosphoric acid are in place, are problems that demand thorough investigation.

WHAT IS NEEDED FOR SUCCESSFUL FIELD EXPERIMENTING.

Unless I greatly err, one of the chief causes of the failure of so much of the honest and thorough field experimenting that has been done, to accomplish its purpose has been that the questions have been too complex, while the work has not been prosecuted far enough to make it all complete.

It is by selecting specific and narrow questions, and working at them systematically and continuously, that we shall secure the most valuable results. There has been too much firing at random. We need to choose proper points of attack be sure of our aim, and concentrate our fire until a breach is made.

CO-OPERATIVE EXPERIMENTING.

And we need not only to work rightly, but to work together. Experiments with a common object on a common plan, conducted by intelligent, careful investigators, in different places, under different but accurately observed and recorded conditions, are needed to bring the results which scientific agriculture so pressingly demands.

A letter from Professor Henry, of the agricultural department of the University of Wisconsin, says most aptly, "What we most need is *union*," and dwells upon the importance of co-operative field experiments with fertilizers, experiments which shall be "*far-reaching*" in their character.

Mr. Sanborn, of the New Hampshire Agricultural College, in alluding to the fact that most of our agricultural science hitherto has come from Europe, and that we need facts and principles of our own, says of the work of field experimenting with fertilizers: "It is of incalculable importance to the country," and adds: "The co-operative plan is the only right thing if quick and reliable work is to be done." And unless I greatly err, these gentlemen, who, with numerous others, are showing their faith by their works, are expressing in the words just quoted a general sentiment of the men who to-day are doing most to promote agricultural science in this country.

Now it seems to me that the way to co-operate is to co-operate. The way to get on is to "stay not upon the order of your going, but go." Go wisely, carefully, rationally, slowly, if need—but go.

The colleges and experiment stations of nine States, and several prominent farmers of the same and other States, have already commenced work on the schedule above explained. Six other colleges and stations have made arrangements to commence the same experiments this season, and three others are experimenting on the same question of the effects of nitrogenous fertilizers, though on somewhat different plans.

Several State agricultural reports show that the same enterprise is being considered by other official bodies as well. The secretary of the Ohio Board of Agriculture, Mr. Chamberlain, in his last report devotes a number of pages to accounts of the nitrogen experiments referred to, and suggests the study of the nitrogen supply for wheat on typical soils in his State. The last report of the commissioner of agriculture of Virginia recommends similar experiments in that State. Several other State organizations are taking steps in the same direction. Besides all these, there are numbers of intelligent farmers throughout the whole country who are able and will be more than willing to contribute most efficient work. The experiments above cited suffice to prove this beyond all doubt.

With the assured co-operation of so many representative men, including really the majority of the best known experimenters in the country, the feasibility of co-operative experimenting is no longer a question.

At the conclusion of Mr. Atwater's paper the chair submitted the question of the experimental stations to the convention for discussion, previous to which he read the following paper from Mr. William Saunders:

The work of experiment stations consists chiefly in investigations and experiments directly or indirectly connected with the nutrition and growth of animals and plants useful in agriculture. Various branches of agricultural technology, and the testing of the quality and value of commercial fertilizers, food materials, and seeds, are also objects of their labors. It is related that of the 40 German stations in operation during the year 1874, 13 were engaged in researches in animal physiology; 20 in vegetable physiology; 5 were busied chiefly with studies in the chemistry and physics of the soil; 4 made a specialty of grape culture and wine production, and 5 of questions in agricultural technology. Besides the work above mentioned, a control of the trade in fertilizers, by analyses of wares bought and sold, was exercised by 28, of that in seeds by 16, and of that in fodder materials by 13 stations.

The care and patience and thoroughness with which these experiments are conducted, the amount of labor and time and money they cost, and the ways by which their results are applied, would be quite astonishing to those unacquainted with these details. A single experiment often requires the hard and unremitting work of several chemists day and night for several weeks or months.

The experiments thus described are numbered by hundreds and even thousands, each one of which has cost the labor of days, weeks, or months. They have called in requisition the services of the ablest scientific men and the most successful farmers. They have involved an incalculable amount of thought, care, and toil in the laboratory, the stable, and the study. Nor has the work been in vain. These investigations have done a vast deal to settle the questions about stock feeding, which are as perplexing as they are important to millions of farmers on both sides of the Atlantic. Combined with the results of daily farm experience, they have shown for what pur-

poses different kinds of fodder materials are best fitted, and how much each is worth. They have taught the farmers how to make valuable fodder out of poor hay and straw; how to employ lucern, clover, and other forage crops to the best advantage; how to utilize waste products, such as flax-seed and cotton-seed and the oil-cake, made from them; also the refuse from the manufacture of sugar from beets, and of alcoholic spirits, and starch from potatoes and grains. They have shown in what proportions these and much of other fodder materials should be mixed and used so as to get the greatest benefit at the least cost, thus supplying farmers with just the information they need in order to keep their stock and produce, meat, dairy products, and whatever else comes from the maintaining of domestic animals, most rationally and with the largest profit. * * *

There is certainly no agricultural country in the world where experimental stations, wisely conducted, can be made of so much direct practical benefit to every tiller of the soil, and consequently to the increase of national wealth, as in these United States; and while we may profit by studying the methods which have been found valuable in the conduction of experiment stations in Europe, as we already have profited (in common with the civilized world) from their magnificent results, our special requirements suggest a wider range of co-operative action in fields which promise practical results equally important and more immediately available in their application than those emanating from the laboratory alone; although chemical analysis is the indispensable factor in all things relating to exact science, yet there are many questions of vast importance to the cultivator of the soil which can only be answered by careful comparison and observation in the fields.

To begin with, the Department of Agriculture should have at its disposal for occupancy a farm of 150 or 200 acres in the District of Columbia, where, in addition to other purposes to be noted further on, space would be secured sufficient to plant a fruit orchard which should contain one specimen of every variety of fruit tree and bush suited to the climate, with provision for adding to the collection all new fruiting plants that may be introduced from time to time, for the purpose of assisting towards a uniform and correct nomenclature, for obtaining a knowledge of their respective values, and for the careful notification of everything valuable which could be obtained by the possession of such a collection.

Then at carefully selected stations in different parts of the country (particularly on account of distinctiveness of climates), establish experiment farms, not exceeding 100 acres in extent each, which amount of land would be amply sufficient for all practical experiments in the line of plants and crops of all kinds, at least at the outset. These farms to be of average good soil in their respective localities, well supplied with water, so that a portion of the land could be employed for experiments in the irrigation of certain crops at certain seasons, and otherwise embracing a fair representation of the particular topographical features of the country contiguous to the location. Suitable accommodations should be provided for the working animals, also offices for the superintendent, and such other officers as might be employed, temporary or otherwise, so that the entomologist, the chemist, the microscopist, the botanist, and others, would here find a place for such work as might be found necessary in their respective duties in connection with the station.

It would, of course, be impossible to enumerate with any degree of accuracy *all* the work which may be performed at or by these stations. As work progressed suggestions would constantly offer themselves in furtherance of the various processes on hand. Some leading objects, however, may be noted.

1. To ascertain, by comparative growth in certain locations, the exact value of the most popular varieties of our cultivated staple plants, with a view to assigning to each its proper isothermal line of pre-eminence. For example, there are numerous varieties of the cotton-plant in cultivation, each one of which has its peculiarities more or less distinctly marked, some producing a short fiber, others a longer, some robust in growth and of great hardihood in regard to ungenial seasons, others the reverse of this, but producing valuable lint, and so on indefinitely. Nothing can well be of more importance to that industry than to possess a thorough knowledge of the exact value of each variety, so as to be enabled to place each kind in the district where it would prove to be best adapted. In this way many varieties would probably be discarded, and their places supplied by others which have shown themselves to be more worthy in every qualification. This knowledge would also be preliminary to the further improvement of the cotton-plant, by crossing varieties, or, it may be, by hybridizing species. This line of improvement is of the greatest importance; certainly no other method of improving either vegetables or animals can lay claim to any approach to scientific accuracy or exactness; and what can be done with the cotton-plant can also be done with tobacco, sorghum, beets, wheat, corn, and in short with all fruits, cereals, and vegetable esculents in cultivation throughout the country.

2. To ascertain to what extent crops may be improved by a mere change of seeds from one climate to another. There are no settled facts bearing upon this point; at all events there are none that are recognized as being beyond dispute, but it is, neverthe-

less, well-known that seeds acquire habits of earliness, lateness, and other peculiarities, according to the climates and conditions of their growth. A series of carefully arranged tests, made through the interchange of seeds from one climate and position to other climates and localities, would undoubtedly be the means by which questions of this character can be properly worked out.

3. *Rotative cropping.*—The advantages of a rotation of crops are sufficiently established, but the exact, or even the approximate rotative value of each plant, is very obscure. For example, it has been stated that strawberries will succeed better when they follow a potato crop than they will otherwise do, and that the tomato will similarly show the advantages it gains by following a crop of melons. Whether these and other claimed peculiarities have any foundation in fact, and if so, how much is dependent upon the mechanical effects of culture, chemical exhaustion, or other causes, opens up an unexplored field of inquiry which will reward serious prosecution.

4. *Value of fertilizers.*—This is a subject which requires but little explanation. The exact specific relations that exist between plant life and plant food is but imperfectly understood, and is in itself an all-important object of experiment.

5. Most of our cultivated races of plants have run into numerous varieties, many of them comparatively worthless. A test of their exact merits, with the result of discarding those of inferior merit, would be the means of throwing from seed lists and plant catalogues many worthless things.

6. There is a pressing necessity for increased facilities for the propagation of new plants, especially of those known as semi-tropical, such as the cinchona, orange, olive, tea, &c., and even some which may be classed as tropical, such as the pine-apple, banana, ginger, coffee, &c. There are sections of the country where the climate will admit of the propagation of all such plants in the field. A station or farm in such a locality would enable the department to furnish plants which would vastly assist the increase of these and similar industries.

7. The organic law creating the department charges it with the following duty: "To test by cultivation the value of such seeds and plants as may require such tests, to propagate such as may be worthy of propagation, and to distribute them among agriculturists." To discharge this duty makes it imperative that land should be occupied by the department in various climates and sections of the States.

These indicate the nature of the work which can be accomplished at experimental farms.

Mr. ALVORD addressed the convention, giving it as his opinion, that the best method of arriving at the results suggested in the papers of Professors Caldwell and Atwater would be to arrive at some form of co-operation between the colleges and private enterprise. The most important problem is how to prevent unintentional duplication of work.

Mr. MCBRIDE offered the following preamble and resolution:

Whereas, the following statements are not to be denied:

1st. That scientific investigation is as much a part of the duty of the agricultural college as teaching.

2d. That many of the most important questions connected with agricultural science are as yet unsettled—many of its principles not formulated.

3d. That these cannot be determined from the data afforded by a few isolated experiments limited in time, season, and locality, but only from those of long-continued series fairly representative of average soils, climates, and seasons.

4th. That system, union of purpose, and concentration of effort are alone capable of giving the most certain and satisfactory results: Therefore, be it

Resolved, That a committee of five be appointed by the chair to whom shall be referred the subject of agricultural experimentation, and whose duty it shall be to report a series of carefully considered experiments bearing on the most important points in agricultural science and practice, to be conducted under the direction of the Commissioner of Agriculture, and in which the agricultural colleges and experiment stations of the country shall be invited to take part.

Mr. COOK suggested that it would be well to examine the original law of Congress establishing agricultural colleges and endowing them; that it called for the publication and exchange of annual reports, and if they are so exchanged between the colleges and read they should be the means of preventing this duplication.

Mr. RUGGLES. I rise with the expectation of remarking upon the co-operative system, which I think is embodied in these resolutions very fully, but I have upon my mind the questions discussed yesterday with regard to education which I wish to comment on in brief. It may

not, perhaps, be considered appropriate, this morning, but if the question of co-operative work and action——

The CHAIRMAN. The question is on the adoption of the resolution offered by Professor McBride.

Mr. RUGGLES. I do not propose to speak upon that point this moment, but rather to the point to which I refer, and also, incidentally upon the subject which I had proposed to present at the time when the president of the convention should deem it most appropriate—that of the practical production of fertilizers by steam.

The CHAIRMAN. I would state to the convention that I have a communication from General Ruggles, which I shall lay before the convention before its adjournment, and ask it to comply with the request to appoint the committee desired.

Mr. GILLHAM, of Illinois, expressed a desire to continue the discussion upon the agricultural colleges. The president stated that the question for consideration was the adoption of the resolutions, and that the report of the committee to which the resolutions would be referred could then be discussed.

Mr. PORTER, of Minnesota. I will occupy but a moment. I represent the State Agricultural Society, the State Horticultural Society and State University of Minnesota, and representing these three organizations I heartily concur in the resolutions, and pledge the best co-operation upon the part of Minnesota.

Mr. AIKEN, of South Carolina, stated that he thought experimental stations were invaluable; that he would like to see one in Washington, one in the South, one in the Middle States, one on the Pacific coast, one in the Mississippi Valley, and he thought that their establishment would result in great benefits to agriculture. He thought that experiments should be carried on, however, with reference to specific soils, climatic conditions, &c., and predicted that all experiments carried on in one section, based upon success in another section, would fail unless these conditions were identical.

The experiments suggested by Professor Atwater might, he said, do very well for land worth $150 an acre, but where land is of no value, and labor is of all value, it was a different matter. Referring to Professor Atwater's suggestion of the application of nitrogen, Mr. Aiken said that in his first crop of corn raised in 1851, he had following his father's method, applied twenty five bushels per acre of a compost of cotton seed and common manure, and had a most beautiful corn crop, but very few grains on the cob.

The experiment suggested by Professor Atwater had been tried by every farmer in his country. It makes a fine weed, but nothing else; the application of ammonia to the plant is like giving liquor to a man, it makes the plant feel big, but it isn't worth anything. There was no farmer in his section who could afford to make the application as suggested by the professor, in applying such expensive fertilizers on lands that were so cheap.

Mr. AIKEN believed that the application of phosphates to the growing crops would tend largely to increase the crops and reduce the expense. He gave his experience with a crop of wheat treated in this manner. To a 25-acre wheat field planted on the 9th of November, he applied his phosphates on March 10, and it was not a week before he could have followed his track by the increased growth. This method he has adopted, and he makes more than his neighbors. He has also followed with good effect the running through his sheep and cow stables of the phosphates, before treatment with sulphuric acid, using the pro-

duct as his fertilizer. He stated that the use of cotton seed as a fertilizer was very little understood by the farmers of the South, and especially by the people of the United States. That where cotton is grown, the seed had become almost too expensive to use as a fertilizer, because of the demand for it for the purpose of making "salad oil." The people of the South are now trying to utilize it in another way. They find that a quart of cotten seed and a pint of oats will keep a sheep one day, and sheep do well all winter upon it. He wanted the professors to come out of their laboratories and go into the fields, and give the farmers the benefit of their labors there. Ninety-nine out of every one hundred never know what is meant by potash, nitrogen, and ammonia, or the difference between them.

Mr. NEILSON of New Jersey, stated that the experimental station there was in close connection with the farmers of that State, and they are directly benefited. Their wants are made known by correspondence with the station.

Professor CALDWELL had referred to the enormous number of papers extant, as the result of twenty five years' work of the German institutions, but that information did not reach us in this country for years, but there is an immense amount of information extant that cannot be had. He advocated the organization of a central bureau, where this valuable information should be gathered, collected, and distributed to the country. He thought the reason why the United States had increased so rapidly was, because of the cheapness of doing things. Emigrants are constantly communicating the resources of the United States to their mother countries, and the result of this meeting should be the adoption of a plan for the organization of a central bureau, for the collection and dissemination of such information.

The time for the usual recess having arrived, it was, on motion, ordered that the first half hour of the afternoon session be devoted to the further discussion of the question.

Before adjournment the chair submitted the following communication:

Hon. GEO. B. LORING,
President of the Agricultural Convention:

SIR: I have the honor to state that I have invented a process of compositing manures and fertilizers by steam for agricultural uses. I have also the honor to request that a committee of five or more members of this convention may be appointed, if found expedient, to report their opinion whether they would consider it advisable that the subject should be experimented upon by the agricultural colleges here represented as a basis of instruction in the interest of agriculture.

DANIEL RUGGLES.

WASHINGTON, *January* 11, 1882.

The PRESIDENT. I ask leave to appoint this committee. Is there objection?

No objection being made, the following committee was appointed: Messrs. Gillham, of Illinois; Buchanan, of Virginia; Clark, of Vermont; Aiken, of South Carolina; Gold, of Connecticut.

And then, at 1.05 p. m., the convention adjourned until 2 o'clock.

AFTERNOON SESSION.

The convention reconvened at 2.20.

In accordance with the motion made before recess the discussion was continued. A delegate from Virginia thought that Mr. Aiken had made some strong points in favor of the adoption of the resolutions, one of them being the almost universal ignorance of agriculturists in

regard to agriculture, and warmly advocated the adoption of the resolution.

Mr. HOLMES, of North Carolina, said that speaking for the University of North Carolina he pledged the hearty support of that institution, and stated further, that they would be glad of an opportunity to carry on experiments in connection with those established at the proposed central station.

Mr. PAGE, of the University of Virginia, was satisfied that the scheme would work well, and desired to advocate it with all the influence he could bring to bear upon it.

Professor ROBERTS, of New York, said we had had a good deal of talk on phosphates, sulphates, and nitrates, but not a word had been said in regard to farm-yard manure, the foundation of all profitable farming. It had been intimated that professors of agriculture did not practice what they preached, did not use their fields instead of their laboratories as objects of illustration. Eight years ago the land upon which he is working produced less than 8 bushels of wheat per acre. It now produces 30 bushels. The highest yield is 46 bushels and 40 pounds. From sustaining a dairy of 14 cows and 4 horses, it now sustains 20 head of cattle and 20 horses.

This had been done by farm manures. He tried commercial fertilizers, but found, for some reason which he did not understand, that phosphates did not act energetically on the soil. He had tried one hundred experiments, carried on through eight consecutive years, and the greatest yield ever produced was from fourteen good two-horse loads of farm-yard manure, which he said did not lay out under the eaves of the barn. A large part of it was soluble, because of holes bored in the floor of the stable.

He had visited Professor Lawes' farm in England, and had been advised to use sulphate of ammonia. He had done so, and the result was no better than the phosphates. He had endeavored to find the reason, and found it to be true that certain localities are not adapted to certain treatment. A large area of country around Ithaca does not respond to phosphates. A large area to the north does respond, and farmers think they cannot get along without them; but these commercial fertilizers are only to supplement that that should be made of the by products of the farm. Referring to cotton-seed meal, he wanted to know why the oil referred to by Mr. Aiken could not be taken out, and the refuse used. Oil was not a manure. He had for two years manufactured farm-yard manures, carefully, and had tried to bring as much skill and education to it as would be brought to the manufacture of anything. If the manure is too damp, he dries it; if too dry, he dampens it. If it has been tramped down, he loosens it up. He has a yard where the manure is manufactured until ready for the field, when the 14 loads is applied per acre. The land upon which he produced the 46 bushels and 20 pounds of wheat per acre was extremely poor.

Mr. BLOUNT, of Colorado, supported the resolutions. The land in his State (Colorado) was worthless, without water. Water, with him, was the great factor. The information to be derived from the proposed station would be of infinite value to his State; he thought the time would come when water would be one of the fertilizers. It costs $1.50 to irrigate an acre. For twenty acres, about $25 a year. They raise from 40 to 90 bushels of wheat per acre. The latter is not an uncommon yield, by plain cultivation. Corn becomes acclimated in about three years; wheat becomes almost indigenous to the soil. Wheat sent him by the department for the last three years would not be recognized; it

gradually gets hard there. They use no fertilizers whatever. The soil 20 feet below is just as good as at the surface, and will yield the first year.

Mr. WELLS, of Michigan. The Michigan Agricultural College is in favor of the passage of the resolution, and I would suggest that in each State where agricultural colleges are already established that they be made branch experimental stations.

Mr. BROWN, of Indiana, said: The Industrial College of Indiana is opening up a State experimental station in connection with the agricultural college. He believed the resolutions were in the right direction, and wanted them passed. The question of time could be reduced by having men at work on the same point in different States.

Mr. WRIGHT, of the Indian Territory, said: The western portion of the Territory is more or less prairie, and something in the soil causes sourness and does not permit the growth of corn. He suggested that the department, while investigating these matters, should ascertain the reason why corn does not grow in prairie countries.

Mr. FERNALD, of Maine, thought the general scope of the resolutions commendable, and in behalf of the Maine State College of Agriculture and Mechanic Arts, he would say that it would join in this co-operative movement to the extent of its ability.

There were some features in the settlement of which all institutions could take part, as, for instance, the nitrogen problem, which several institutions in one section of the country could settle for that particular section in work of this sort. Not a very large number of experiments should be undertaken at any one time, but the few prosecuted thoroughly and for a series of years until regarded as settled.

The delegate from Maryland, Mr. WARFILD, representing the Agricultural College of Maryland, situated nine miles from Washington, said: We have 286 acres of land that is well adapted for experiments, either as a central governmental station or as a co-operative experimental station, and the legislature would be very willing to offer any portion of it to the Commissioner of Agriculture, or to take up such experiments as the Commissioner of Agriculture would be willing and ready to have made; and I, therefore, on the part of the institution, in the absence of its president, make this statement.

Mr. SARGENT, of California, was in favor of the adoption of the resolution. He thought that the arid regions could be increased in value by the experiments carried on under these resolutions. He believed that with a proper system of irrigation a vast area of these regions would be found to possess all the elements of fertility described by the gentleman from Colorado. He desired, if possible, to have a construction put upon the resolutions that should enable the proposed station to deal with the vast problem affecting this region, as for instance, to ascertain whether there are not vegetable fibers which will grow there. That region should be made to adapt itself to man's necessities, and to become what it should be, the new home of the many millions which this country by and by will contain.

Mr. ALVORD. I merely rise to suggest that I think the matter of temperature, climate, condition of air and earth, have been too much lost sight of. I see we have with us a representative of the Signal Service of the United States Army, one of General Hazen's assistants, and I think we might, by common consent, extend the time sufficiently to hear from him as to what the Signal Service is doing and proposes to do.

The PRESIDENT: The chair will state that the question is not within the range of the resolution at all. The chair has extended an invita-

tion through General Hazen to his assistant to prepare a written paper on the meteorological conditions for the consideration of the convention.

That question will come up at the proper time. It might come up this afternoon, after the paper of Professor Peabody; but I am informed that the gentleman has not had time to prepare his paper, and the matter will have to be passed over. Is the convention ready for the question?

There being no further discussion, the resolutions were adopted, and the following committee was appointed: Messrs. McBride, Caldwell, Atwater, Sargent, Alvord.

The chair takes pleasure in extending an invitation to all delegates to meet the President of the United States in the East Room of the White House at seven o'clock this evening.

The PRESIDENT. The business now before the convention is a paper by Professor Peabody, whom I have the pleasure of introducing to the convention.

WHAT WORK IS LEGITIMATE TO THE INSTITUTIONS FOUNDED ON THE CONGRESSIONAL GRANT OF 1862.

BY SELIM H. PEABODY, Ph.D., LL.D., *Regent of the Illinois Industrial University.*

The great exposition in London, in 1851, was the first of those gatherings in which the workmen of the world have competed for supremacy in those arts which mark the development of mankind in the nineteenth century. It proved to be a grand awakening of the thought of the nations, America included, to the fact that those peoples who had most faithfully fostered the advancement of scientific discovery, with its application to practical arts, were making the most rapid stride in every line of material progress. Especially was it apparent in America that there was an imperative demand for higher technical instruction in every direction of human art, enterprise, and labor; in agriculture, in engineering, in architecture, in mining, and in all departments of manufactures. In a few particulars we had demonstrated the wonderful versatility of the American mind, its ready adaptability to new circumstances amid untried conditions; its fertility of invention; its quickness of acquisition; its grasp and strength, and tireless activity. With this demonstration came also the conviction that the need of the time, the inexorable demand of the nation, was the need and the demand for technical instruction, such as could then be found nowhere on this side of the Atlantic. This leaven was fermenting in every thinking mind. A few schools were in operation. Efforts were everywhere made to open others. There was a school of engineering at Troy. There were scientific departments at Harvard, Yale, and Dartmouth. Pennsylvania and Michigan had founded schools of agriculture. Other schools of applied science were contemplated. There was great difficulty in securing the endowments, without which such enterprises could not thrive. As the want to be supplied was of national extent, as the benefits to be secured were such as would increase the nation's wealth and develop the nation's prosperity, the idea was born—some say in Illinois—to seek aid of the nation at the hands of the Federal Government.

During President Buchanan's administration a bill was introduced into Congress by Mr. (now Senator) Morrill, of Vermont, which bill provided that a part of the public domain should be distributed to the several States for the foundation of schools in which technical instruction should be given. The bill was advocated before the House in an able speech by Mr. Morrill; was thoroughly discussed and bitterly opposed in the Senate, and finally passed by a close vote, only to fail by reason of the veto of the President. During the first year of President Lincoln's administration the measure was again proposed; again passed both Houses of Congress, and became a law on the 2d of July, 1862. Nothing could have been more significant of the abiding faith which Congress then cherished as to the perpetuity of the Federal Government than the passage of this act in one of the darkest hours of the terrific struggle then going forward. No part of this act is more thoroughly familiar to each person who hears me than that section which so briefly, so concisely, yet with such generous provision, such breadth of permission, describes and defines the purposes to which the funds donated in the act shall be devoted. Apparently, as clear as the day, as luminous as light, the interpretations given to this section are marvelously diverse, and often diametrically opposite. I had almost come to think the subject trite and its consideration needless, and yet the discussions of yesterday have led me

to believe that even now it may be wise to pause, hunt up the statute, and see how reads the law.

"The leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

What may be done legitimately in carrying into operation the instructions of this law? As has been suggested, each person has his own interpretation, and I crave brief forbearance while I present mine.

First. The business of each institution resting on this grant is TO TEACH.

An institution of learning, especially of scientific learning, has usually a twofold function, namely, the acquisition of knowledge and its dissemination. Either function may predominate, or the two may be made co-ordinate and mutually helpful. If, however, I read this law rightly, the end it requires is instruction. While it permits, by inference, in another place, that effort may be expended in the acquisition of knowledge, this permission is only by inference, and the labor so employed should be such only as may be made directly useful in stimulating and broadening and assisting instruction. If it be possible to draw a line sharply and distinctively between a school for the instruction of students, in which their mental growth and their scientific training shall be the absorbing interest, and an experimental station, in which the development of science in and for itself shall be the chief business, then the institutions founded on this act should be schools, and not experimental stations. A purely experimental station, however essential to science, however useful to the general welfare, however practical in the results which it may procure, if it be divorced from the instruction of pupils, does not answer the spirit of the requirements of this law. If the experiments can be so conducted as to help the advancement of the student, to quicken his perception, to broaden his judgment, to stimulate his energies, to illustrate the science in which he strives for the mastery, to assist even indirectly in the instruction which it is the real business of the institution to impart, then they are legitimate and should be fostered. The greater part of such experiments will not be found developing new science or breaking up new ground. The ground will be new to the pupil; the work will offer to him absorbing interest, because it is novel, and it will be imperatively needed by him either as teaching him how to conduct similar work in the future, or as illuminating the ground over which he must tread and with which he must be familiar before he can be fitted to enter upon fields wholly unexplored.

I dwell upon this point because it seems to have been assumed on one or two occasions, in our discussions, that if any institution, for want of opportunity, or of means, or because of other occupation, is not at work at some unsolved problem, and developing something new in science, it is therefore derelict in duty and is to be condemned as a failure. On the contrary, I believe that the time and strength of a professor, and in so far of an institution, may be so absorbed in that most interesting and fascinating employment, the pursuit of new science, and the solution of new problems, that he may neglect the more important duties of teaching the students who have been confided to his care. In most cases I apprehend that the conscientious teacher will find the time at his disposal all too short in which to conduct his pupil over the well-known ground of clearly established truth, and that the illumination which he can and must shed upon that truth will absorb all the means and time and strength at his disposal. His first and paramount duty is instruction. If his investigation will help his instruction, let him investigate; if it interferes with his instruction, let him obey the law and TEACH.

Second. What shall be taught?

With its wide latitude of permission, the law specifies but one subject which shall be taught, and that is military tactics. Possibly some of those who conduct the institutions in question would be glad if the act had been signed at its first passage, when this item was not included. Yet there may be grave question whether the schools would indeed be better if this requirement were omitted. The discipline, the physical culture, the development of manly vigor and gentlemanly bearing, the training in the use of arms and in the management of men, is worth, in my judgment, all it costs in a course of other study. The government, in all cases that I have known, has furnished the equipment when asked, and in most cases has detailed an instructor, free of cost, to the institution. I believe that good faith and simple honesty requires from every institution under this act, obedience to this item of the law, and that each student not physically incapacitated should be required to learn the manual of arms and the maneuvers and command of a company. The evasion of this law on the part of college governments is an unfortunate lesson to their students as to the doctrine and the duty of obedience.

But this item of military tactics is merely an incidental thing put into the act under the inspiration of the conflict which was raging when the act became a law. The grand purpose of the enactment is stated in the words, "to teach such branches of

learning as are related to agriculture and the mechanic arts * * * in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

What does this mean? Why, says my farming friend, that means agriculture. The agricultural press throughout the country proclaims that it means agriculture. It has been so urged by members of this convention. The bill was known during its first and second passage through Congress as the Agricultural College Bill. The institutions founded thereon are commonly called the agricultural colleges. There is a large body of people in the country who insist that these colleges (1) ought to teach agriculture; (2) ought to teach nothing but agriculture, and (3) that they do not teach agriculture. Those who adhere to either of these propositions are in error in some greater or less degree.

It is certain that agriculture as a topic to be taught in these institutions is a topic of first importance. The law so states and so intends. But with equal precision the law requires that instruction shall be given in subjects which pertain to "the mechanic arts," that the students thereof may be prepared to enter the "several pursuits and professions of life." The law uses the same emphasis and the same authority in specifying the one item which it uses in stating the other. If the Massachusetts Institute of Technology, which enjoys a part of the income from the grant of 1862 to that State, errs in not teaching subjects which relate specifically to agriculture, the Massachusetts Agricultural College, which has the remainder of that income, errs just as grievously in that it does not teach subjects which relate specifically to the mechanic arts. But, nevertheless, the State of Massachusetts, having provided in these two institutions for instruction in both agriculture and the mechanic arts, fulfills her whole duty under the law. Her sons may choose the line of study which seems to them best suited to their capacities, their aspirations, or their hopes for gaining a livelihood. If, at Amherst, they have learned the principles and the practice of agriculture they have done well. If, at Boston, they have learned the theories and the arts which make them skillful mechanicians they have also done well. The State will be benefited by the genius and the skill of either. If the requirements of the law may thus without doubt be satisfied by these separate institutions, these requirements may with equal fullness be satisfied by the conduct of two or more departments in the same institution. The graduate who leaves such a school is not to be blamed even if he has not learned agriculture. He is to receive credit for faithful study and useful acquisition if he has perfected himself in any technical learning which has promoted his liberal and practical education for any of the several pursuits and professions of life.

For the term "mechanic arts," in the light of its subsequent amplification and explanation, is not by any means to be restricted to the arts of devising, building, and operating machinery, unquestionably included in that term. The art may be that of constructing the railway, as well as of building and running the locomotive that treads its iron track. It may erect the bridges that span the stream that track crosses. It may and should include the designing and construction of the stations that make its termini; or of any other edifices that men need to use in business, or want to love as homes, or to admire as monuments of public munificence. The science of the chemist that may develop the art of the dyer, or the skill of the assayer and the metallurgist, or of the refiner of sugar, or of use in the thousand forms of usefulness to which chemistry reaches forth its helping hand; the science of the electrician that builds our telegraphs, or will illuminate our cities and brighten our homes; the art of the designer that lends beauty to the products of the loom, that shapes the clay of the potter into things of perennial joy, that sheds its halo of delight over all things precious or common place, adding untold wealth to the crude products of rude mechanical toil; these, and a myriad more, in ways that science alone has opened and will open as the avenues to a livelihood or to a competency, are the lines of work that legitimately have place in the instruction of institutions of learning which the State has founded for the education of the industrial classes in the several pursuits and professions of life. Nay, more; unless the institutions in question do provide in some manner and to some extent for instruction that shall bear fruit in some of these ways, as well as in agriculture, they are delinquent in their duty towards the law which created them, and towards the needs of the public for whose benefit they are and were founded, for it needs no argument before this body to show that the greater the number, and the more diversified the nature, of the industries which occupy the labor and skill of a people the greater will be the prosperity of that people. It is no more fitting that all men shall be farmers, than that every farmer should raise only corn, or cotton, or hogs. When all farmers have learned how to make two blades of grass grow where but one grew before, there will not be occupation for as many grass-growing farmers as were required before that consummation had been reached.

It is true that these colleges, save as teaching may be divided as before indicated, are bound to teach agriculture. It is equally true that they are required to teach a wide curriculum of science and art beside agriculture. But it is said that they do not teach agriculture, and that they draw the sons of farmers away from agriculture, and

teach them to despise labor. Most statements of this sort are based upon observation limited to individual cases, and so far as I am able to observe lack breadth of information. From the earliest days of the republic farmers' sons have turned their backs upon the farm to enter upon pursuits which required less manual toil. That the farm has furnished largely the fresh blood that has enriched the learned professions with strong and noble exemplars, has been the boast alike of the farmers and of the professions. From the farms went the Washingtons and Jeffersons, the Clays and Websters, the Lincolns and Garfields, whose renown has been the aureole about the brow of our nation of free laborers. Never have I heard that even the farmers have mourned because such men exchanged the labor of their hands for the severer and more exhaustful labor of their brains. But even these men never lost their affection for the soil whence they sprang; when wearied with the conflicts of the arena, whether victors or vanquished, they sought renewed vigor in the embracing arms of the dear mother who had nourished their sturdy youth.

It is sometimes asserted that enough of labor is not required at the hands of students, and that students who are not so made to work are not taught agriculture. If the work which can be put before students is something which develops manual skill, in which practice leads to perfection, in which brain has its part, then it is useful to the student, he loves it, and is always ready to attack it. Our American boys will always work when they can see the profit of it. They will not work kindly in school or after they leave school, at things which a dullard, or a brute, or a machine can do as well, and for the very sensible reason that they know it does not pay. The manual labor that is put regularly and systematically before the boys in one of the very best schools where this system prevails—work which was provided because no other was to be had—consisted mainly of such labor as spreading heaps of manure, chopping brush, digging potatoes and ditches, and other occupations of like drudgery, which most knew all about before they came to college, and which any of the others learned to do perfectly in the first hour's trial. That which the boy comes to college to learn is not that which he has already learned or can learn at home; he were foolish to go from home for such instruction. He goes to learn something which his farm work will not bring to his knowledge.

Nor is it true that these colleges educate the boys away from the farm or away from labor. Of the students who attend the Illinois Industrial University about 75 per cent. come from farmers' families; 80 per cent. are young men. About 55 per cent. choose technical courses, divided with considerable uniformity between agriculture, chemistry, architecture, mechanics, mining, and civil engineering. It rarely happens that a student leaves a technical course for a literary course, while it is a common occurrence that one who has witnessed the practical work about him, the fullness of experiment, and the interest it awakens, it is common that such a student turns from a literary to a technical course. Our paths lead toward science, rarely from science. Farmers' sons who come to us and enroll their names as taking other courses of study very frequently pursue some parts of the agricultural course, as collateral work, intending at the end of their college life to go back to the farm, so that it is now true that a much greater per cent. of our alumni are farmers, than the percentage of our students who are, or were, special students of agriculture.

As a rule, young men choose such courses of study as they believe, from the best information in their possession, will lead them to immediate and lucrative employment. Especially is this true of students in technical schools. If young men could be brought to believe that trained agriculturists could command wages commensurate with the expense of the training, ten would undertake this course of discipline for one who now enters upon it. Such demand for educated farmers as has been described at this convention may exist; but such knowledge of it as will help intending graduates to find business after graduation, does not come to those who have charge of institutions, who would gladly bring employers and employés into communication. During the last year the officers of the institution I represent furnished fifteen to twenty assistants to engineers of lake and river surveys, and of railway lines, applying for such help. This year the engineering classes are crowded. There is a like demand for machinists and architects, and with like results. The same conditions do not exist for agriculturists.

The Illinois Industrial University offers a wide opportunity for choice of studies to those who knock at its portals. First and completest has been its equipment for agriculture. It has one hundred and fifty acres of land devoted entirely to experimental uses in agriculture, horticulture, arboriculture, orcharding, vineyards, small fruits, druggists' herbs, anything which may promise useful variety to tillers of the ground. It has a stock farm of 400 acres, on which students are shown the conduct of the business of raising crops and feeding cattle with a view to economy and profit, and this farm yields annually a fair remuneration to the treasury of the college. It keeps constantly from 150 to 200 head of cattle of all ages; some of gentle breeding, others of graded stock of various qualities and strains, by which to illustrate their relative value for profitable handling. It is well supplied with tools and implements that are carefully managed and tested. The department is under the charge of a professor (Prof.

George E. Morrow), of whom I would gladly say more if he were not here present to object. We have yet to learn of his superior in the West. The professor of botany and horticulture is equally master of his specialties. Competent collateral instruction is fully provided.

The courses in agriculture are greatly varied. If a student can afford time for a complete course of four years, he will find every term thereof crowded with profitable work. If one year is all that he can give, a course of special technical work is arranged for him. If he would choose a course for himself, of greater or less length, the choice is limited only by his own advancement, or by the current programmes of the terms. If the winter term is one which he can spare from active labor on the farm, a series of lecture courses is open to him, for which no special preparation is required. Finally, in most years, a farmers' institute of one week is held in January, to which all farmers are invited. If there is any way in which agriculture can be offered by which it can be more attractive, or more profitable, or better adjusted to meet the wants of the recipient, we shall be glad to be advised of that way. Yet the fact remains that comparatively few students out of our whole number take a course of agricultural instruction in any of the forms mentioned. The truth is that our Illinois farmers cultivate a soil so fertile, so sure to honor their drafts, that they cannot abuse it so badly but it will give them always a support, and generally bountiful profits. These farmers cannot realize that agricultural education can increase their profits, or improve their situation.

I will not take space to detail the equipment of our university in other technical departments. Our laboratories and shops, the machine-shop, and the carpenter's shop, are full beyond our means of supplying room and tools. The young men are eager to work in these specialties. One year ago, through the liberality of the secretary of state, a room in the State capitol at Springfield, spacious, elegant, and most conveniently situated, was placed at my disposal, in which was arranged an exhibit showing the products of students' work alone, all other being strictly excluded, which required two freight-cars to transport from Champaign to Springfield. Each school of technical art was represented—agriculture and horticulture, with fruits and grains and wood and models. Chemistry, with a long list of chemical and pharmaceutical preparations, and an exhibit of sorghum products of great variety, and of good quality. Mechanism, with a complete set of its shop-practice objects, and a large collection of mechanical models, all made by student workmen. A like set of shop-practice objects from the carpenter-shop, with accurate models of roofs, bridges, stairs, and every form of joiner and cabinet work. Specimens of natural history, mounted with life-like grace and beauty, and drawings from all schools, conspicuous for accuracy, perfection, and adaptation to useful art.

This university has passed the time of telling what it proposes to do and what it hopes to accomplish. It has entered upon the stage where it can show something which it has done; yet it is to be hoped without being in any sense content to rest upon any laurels it may have won.

I have thus far spoken of the duty of the so-called agricultural colleges to furnish instruction in branches which may lay the foundation for a means of getting a living. But this is not the noblest function of an institution designed to train the young, whatever may be the practical end immediately sought. The first business of any school is to develop men. Those whom the honorable Commissioner (Mr. Loring) described to us yesterday as wanted, as in eager demand, a demand far beyond the supply, for agricultural employment as florists and gardeners and farm managers; those whom the distinguished gentleman from South Carolina (General Aiken) desired to transplant to his sunny fields as farm superintendents, were in every case to be men. Men of good brain, of good muscle, in full health and stalwart vigor, physically, mentally, morally. They must be men of fair culture, ready in business, in the market, in society, in the discharge of every duty as citizens, to meet and wrestle with the men who are trained in other schools and by other methods. A fatal error will have been committed if their training has been confined to the technical studies which, however useful they may be, are useful in only a certain narrow and limited scope. There must have been developed a power to think clearly and quickly; to reason logically; to express fluently and intelligibly the ideas which have been gathered in the school, or have germinated in their own minds. There is value in all the culture of finer grain which comes from any acquaintance with the humanities, with the thoughts of men who lived in other ages, and spake in other tongues. If there be any form of education that makes any man stronger and wiser and nobler, the farmer and the artisan, the machinist and the engineer, the architect and the designer, and especially he who in any capacity is to be the guide and director and controller of men, needs that culture, that education in its fullest extent.

And so it was that the man who drew this act under which our schools have the right of life and of maintenance, added that these things which were specified, and which we have at some length discussed, should be done and taught "without excluding other scientific and classical studies." The technical studies are to be first provided for, but

there shall be no prohibition or exclusion of other scientific subjects, or even of the classical studies which so many who affect to be practical pretend to despise. Practical training is demanded and liberal culture as well is to be cherished. If the farmer's boy tastes a little Latin it will not harm him. Even if, as is rarely the case, he unearths a Greek root, phosphorescent with age, it will not destroy him. If the mechanic or the engineer, or the technical student in any specialty, would open the doors which look into French or German apartments in the temple of science, he will find there stored vast accumulations of precious learning in the very things which he most earnestly covets, which possessed, will add vastly to his stores of knowledge, while the act of acquisition will give keener edge and quicker play to the weapons of his mental armory.

For every mind a discipline is needed which comes from an acquaintance with other subjects than those pertaining to pure science, or to applied science, however useful those may be. The graduate of any higher school ought to know something of the laws of his own mental activity; something of the principles and methods of the government of which he is a part, and which, in some of its higher or lower departments, he may be called to administration; something of the laws of wealth and the great economies which govern production and distribution and consumption; something of the physical history of the world and of its relation to the rest of God's creation; something of the history of his own race, as it has lived on this earth, with the details of the grand march of history along the highway of nations; something of his own language and its literature, the thought, pregnant with power which the creative minds of his own and of elder days have produced, and which now, in many unrecognized but forceful influences, make up so much of the staple of our thinking and of our present culture. Never does the student gain all his acquisitions at the feet of his preceptors. The outlines only are there acquired; the impulse is received; preferences established, mental bent obtained; the development progresses while the thinking mind endures. But the doors into all these apartments of human knowledge, and to all these sources of higher culture, should have been opened to all young men and women that they may at least know what munificence of intellectual wealth lies within their reach, and these opportunities should be furnished in the technical, as well as in the literary or the classical school.

What is legitimate to the schools resting on the grant of 1862?

All forms of technical education, and in the wide scope of possibilities, every form of human learning which it has fallen to the fortune of mankind to devise or acquire.

The CHAIR. The paper is now before the convention for discussion.

Mr. WARFIELD stated that the paper expressed the sentiments of the faculty of the Maryland College. The question raised was one which he had often proposed and debated in conventions, and in all cases the preponderance of opinion was that a man to make a progressive, active farmer should know something of every department of science. That had been the idea of his college, but a narrow-minded legislature had crippled them. He referred to a meeting held in Washington two years ago, at which resolutions were offered and carried asking Congress to devote at least one-quarter of the proceeds from the sale of public lands to the further endowment of agricultural and mechanical institutions. He advocated the passage of a resolution looking to the appropriation of some portion of the $200,000,000 now lying in the Treasury for the further endowment of these institutions, that the work so ably and intelligently begun may be carried to completion.

Mr. HEDGES, of Missouri, spoke of the urgent need of some fostering care in the production of our own sweets—sugar and molasses—and dwelt at length upon the development of the sugar industry throughout the North and West during the past few years.

Mr. BAIRD said that if the causes set forth by Professor Peabody for the lack of interest were real, which he was inclined to question, that it rather reflected upon the kind of agricultural education given in the Illinois University. Michigan had no trouble in filling her agricultural colleges with students. That State had a university as well known as any in the country; students were given a four years' classical course, and every student who graduates at the college has to take agriculture, and the sciences which underlie it. He warmly defended the management of the industrial institutions of Michigan, and testified to the

benefit the farmers derived therefrom. He did not believe there was any excuse for the lack of interest in the agricultural education, and explained at considerable length the workings of the Michigan Agricultural College.

A delegate rose to second the remarks made by Mr. Baird, stating that the colleges of his State are based upon the plan of Michigan; that students were taught to labor rather than to ignore its importance—to labor in the field at practical work.

Mr. DANIELS, of Virginia, followed in a speech advocating the teaching of students to combine the work of the hand with the work of the brain.

Dr. GREGORY had been connected officially with both the Illinois and the Michigan Agricultural Colleges. He ascribed the success that had attended the Michigan Agricultural College to the fact that the college was three miles from anywhere, and that the boys were obliged to board in the buildings and live on the farm, thus confining their attention to matters pertaining to their studies there.

In the course of a long speech upon the advantages of this system, Dr. Gregory stated that upon the occasion of a visit to Baron Liebig he had stated to him that the great question agitating the colleges of this country was the relative value of agricultural colleges as separate institutions and as connected with the universities. The baron replied that there was no doubt in the matter, and referred him to what he considered the best agricultural college, which was found to be connected with a theological college.

Mr. FERNALD, of Maine, spoke of the valuable paper to which the convention had listened, and hoped a goodly number would be printed for distribution. He referred to a bill in Congress looking to the further endowment of these institutions, and spoke of the benefits to be derived from such further endowment. He called the attention of those present to one point in the bill, the general method of distribution. For the first ten years the distribution from the proceeds from the sale of public lands and patents is to be based upon illiteracy. He questioned the propriety of such a distribution, as it gave to those States having a large percentage of illiteracy many times the amount for ten years that would be given to those having a smaller per cent., and he thought that a change in the bill should be effected.

The CHAIR suggested that a committee of three be appointed to wait upon Mr. Morrill, the author of the bill, instead of appealing direct to Congress, as he had no doubt a proper understanding of the bill could be reached.

Professor ROBERTS moved that a committee of three be appointed to take into consideration this matter, to be designated by the chair. The motion was agreed to, and the following committee was appointed: Messrs. Roberts, Fernald, and Warfield.

The PRESIDENT. The chair will state that any committee appointed at any one convention will have the privilege of reporting at any time during the sessions of the several conventions.

Mr. HOLMES, from the committee on permanent organization, reported the election of Dr. G. B. Loring as chairman of the various conventions.

The PRESIDENT. I desire to say that I am perfectly willing to do anything desired by the convention, and, in accepting the honor, I reserve the liberty to call other gentlemen to the chair whenever necessary. The first business in the morning will be a paper by General Jackson, of Tennessee, upon the blood-horse, and a very interesting, very useful,

very entertaining paper it will be. The discussion which will follow this and other papers will be extremely interesting. I have no doubt.

There being no further business, the convention adjourned at 5.10 p. m.

JANUARY 12, 1882.

The convention was called to order at 10.12 a. m.

Professor Holmes presented the report of the committee on permanent organization, as follows:

The committee on organization nominate the following officers of the Convention on Animal Industries:

Chairman, Dr. Geo. B. Loring, of Massachusetts.

Vice-Presidents, in addition to those named January 10:—Dr. Jas. Law, of New York; General W. W. Grout, of Vermont; Mr. Warfield, of Maryland; Col. Robert Beverly, of Virginia; Mr. S. M. Emery, of Minnesota; General Wm. H. Jackson, of Tennessee; Hon. Geo. R. Black, of Georgia; Hon. D. B. Gilham, of Illinois; Hon. D. Wyatt Aiken, of South Carolina; Mr. J. D. Whitham, of West Virginia; Col. James Young, of Pennsylvania; Maj. Campbell Brown, of Tennessee; Mr. Z. A. Gilbert, of Maine.

Secretaries.—General Geo. E Bryant, of Wisconsin; Mr. James Neilson, of New Jersey.

JAS. A. HOLMES,
Secretary of Committee on Organization.

The CHAIRMAN. I would suggest that it is very desirable that delegates having papers to present should give their titles to the secretary in order that they may enter them on the programme of each day's proceedings. The first business in order this morning is the reading of a paper on the "blood-horse," by General Jackson, of Tennessee, who I now have the pleasure of introducing to the convention.

General JACKSON. *Mr. President, and Gentlemen of the Convention:* Before proceeding with the reading of the essay which has been assigned me by the President of the Tennessee Stock Breeders' Association, on the "Blood Horse," you will, I hope, indulge me in a few remarks touching the Department of Agriculture. My long association with agricultural organizations throughout the West, South, and Northwest, sometimes as a private in the ranks, at others presiding over the deliberations of those conventions, leads me to say that the general impression that has gone out respecting the Department of Agriculture is that it has been deficient in those practical results which the husbandmen of the country so much desire. To use a medical simile, for the office of Commissioner of Agriculture, they think that his normal condition is *otium cum dignitate* and, if by reason of some pet theory the pulsations of the heart are caused to be too frequent, he restores himself to his normal condition by changing the formula to *otium cum digitalis.*

Now I am happy to compliment the present Commissioner of Agriculture in what I deem a new departure, and for myself, I see in this movement evidence of what I think will be productive of good. That these meetings for consultation and discussion *are* productive of great good, I know from my experience in the past, and recognize the fact that we have only to look at the associated effort in mining, manufactures, and railroads, and the many channels through which capital seeks accumulation, to convince us of the necessity of this concert of action. I am gratified and rejoiced to see present with us such a number of the law-makers of the country, and it is a sign of improvement when these gentlemen lend us their presence, and I hope it will result in encouraging and promoting this grand work, for, gentlemen, permit

me to say that that business upon which the permanency and splendor of the government rests, should receive that degree of consideration, protection, and encouragement from the law-makers of the country which, by right, the farmers of our land are entitled to by reason of the taxes and revenue imposts paid by them. Again, I see signs of improvement in this. I believe that our present Commissioner of Agriculture, aided by the general government, will make this department what it should be, a grand receptacle of reported experiments of theory and practice; that he will receive them here at this central station of experimentation, and in this grand national laboratory, so to speak, submit them to the crucial test, eliminating the pure grain from the chaff or the practical from the impractical, and send them forward from this great national focus that they may radiate to the great fields of agriculture, and there, like bread cast upon the water, return in a short time to enlighten the minds and gladden the hearts of the husbandmen, while still further strengthening this rich government. I deem it proper, gentlemen, to say that it has been a pet theory of mine to enlarge this Department of Agriculture so that it can be productive of practical and grand results. As a farmer, I would state that my self-respect will always impel me to use all legitimate means to ennoble and dignify the vocation which the Creator of the universe honored by planting the garden eastward in Eden, and requiring man to dress it and keep it. As a citizen of this great republic, destined to lead the civilization of the world and spread abroad over the earth the benignant rays of a pure Christianity, it is my duty and my pleasure to contribute my mite to the enlightenment and the progress, to the refinement and culture of that class which, like the granite that underlies our mountain chains, sustains the burdens of government, while it gives stability and strength to the great principles which should mold and control and fashion the grand superstructure of human society. I would state that the subject of my essay, as I have said before, was selected for me by Major Vanderford, president of the Stock Breeders' Association of Tennessee, and is a subject which is in entire accord with my taste. The ideas and observations which I shall present are the joint productions and the experience of the veteran breeder, General W. G. Harding, of Tennessee (with whom I have enjoyed intimate association for the past thirteen years), and my own. I would state that I had but a few days' notice before proceeding to Washington for the preparation of this, and I owe my apology for the crude essay which I have now to present to your honorable body:

ESSAY ON THE BLOOD HORSE.

By W. H. Jackson, of Tennessee.

Mr. President and Gentlemen of the Convention: The subject of my essay, "The Blood Horse," was selected for me by Major Vanderford, the president of the Stock Breeders' Association of Tennessee, and notification given me a few days before leaving for Washington. I offer this in apology for the crude one I now present to your honorable body. The ideas and experience herein given are the joint productions of the veteran breeder, General W. G. Harding (with whom I have been associated most intimately, under the same roof, for the past thirteen years), and my own. I have no doubt Major Vanderford supposed that all other subjects pertaining to "animal industry," except this one, would be occupied, hence his reason for assigning it to me.

Among all the numerous varieties of domestic animals which a benevolent Providence has created for the use of man, the blood-horse stands pre-eminent, without a compeer in the animal kingdom. The uninitiated may ask, what do you mean by a thoroughbred or blood-horse? I mean the horse which traces back, with certainty through a long line of distinguished ancestry, to the beautiful and game little creat

ures, which were imported into England from the deserts of Arabia about the middle of the sixteenth century. How they came to Arabia, or by what means they had been brought to the degree of perfection they possessed at that early period I am not able to answer.

THE SUPERIOR CHARACTERISTICS OF THIS ANIMAL.

In beauty he is without a rival in the equine family; a coat as fine as satin, his eye in repose as mild and gentle as the lamb; under excitement as bright as the eagle and as bold as the lion, denoting the energy of his nature; his skin as thin and elastic as the fawn; his form as perfect and well placed as beautifully defined muscles can make it.

This is his exterior, or that which is visible to the naked eye; but there is an interior or invisible structure that contributes more, perhaps, to his powers than even his perfect exterior formation. His large heart and capacious lungs give him the wind of the high-bred hound; his large blood-vessels and soft, thin skin, enable him to throw off the excess of heat that must be generated by great and rapid exertion, especially in a heated atmosphere; his muscles, firm and beautifully defined, with bone of ivory texture—all combine to give him strength, endurance, action, and beauty far exceeding all of his race.

The uninstructed in this particular branch of animal industry may inquire, how do you know of this internal and invisible structure? The veterinary surgeon will answer, "By dissection of blood-horses we find universally large heart, capacious blood-vessels, thin skin, and ivory-like bone, possessing solidity, and consequently strength, far superior to coarse breeds." Therefore, when we know that the pedigree is pure, we also know that this perfect internal structure exists. From the time of the introduction of this horse into England to the present, the best talent of intelligent breeders has been zealously and energetically employed throughout the world, aided, too, by all the leading governments (except our own) to develop and improve this noble animal. They have not failed. By attention to his comfort, with a liberal supply of proper food from infancy to maturity, his size has been enlarged, consequently his strength and speed increased; though beautiful when brought from his native desert, he has attained such perfection in symmetry and strength that breeders of the present period are puzzled to know what further improvement can be anticipated.

The many admirable qualities I claim for this magnificent animal do not constitute his chief, nay, nor his greatest value. His high mission is to improve all of the equine race. The pure and unadulterated blood that flows in his veins improves and gives additional value to all the horse family. To the child's pony it imparts more action, sprightliness, and beauty; to the saddle-horse more action, durability, and style; to the trotter, a class of animals at present so highly prized and for which such fabulous prices are paid, this blood is indispensable, for without it, with all his strength, when pressed, his muscles will tire and he will grow weak for want of breath, the natural result, not of his exterior formation, but of his defective internal organization.

I quote from Col. Jno. P. Reynolds, then editor of the National Live Stock Journal, published at Chicago, on this subject, as follows, viz: "So far as we are advised and believe, there is no individual fast trotter, nor admitted family of trotters, whose blood, if known, is not traceable in part to the thoroughbred. In other words, thoroughbred blood, if not the foundation, the *sine qua non*, of speed at the trot, and, we may add, at any other gait, is always present where speed is found. There is no speed without blood; and we think the inference fair, that none is expected." The question is frequently asked, with all the perfection you claim for the blood-horse, do you esteem him the horse of all work? I answer, No. The horse of all work is a misnomer. No such horse or breed exists. The horse is now an inhabitant of all countries, of nearly every clime, from the torrid to the frigid zone; used by all people (civilized) under varied and totally different circumstances and for different purposes; of course no single animal or breed can be best adapted to all those various circumstances and conditions, but I affirm that he is better adapted to a greater variety of uses than any of his race.

The veteran breeder, General Harding, after an experience of forty years, says: "The best and most durable plow horse I ever owned was a thoroughbred. On a hot day and in high corn (the most severe test for farm stock) he could kill all the horses and mules that would keep up with him, without injury to himself. The best, most active and durable saddle-horse I ever owned was a blood-horse. I rode this horse until he was twenty-four years of age before he ever fell with me or made a bad blunder. I then set him free, and had the pleasure of providing for his comfort for several years after.

The best harness horses I have used were well bred. I find them more sensible and more bold, consequently more safe and reliable. The best mules I ever worked were from thoroughbred mares. Indeed, no animal is more improved by a dash of blood than the mule; it imparts to him the action and spirit which he so greatly needs. To form an idea of the wonderful powers of the blood-horse, we will suppose his weight

mares, have an eye to purity of pedigree, and that they spring from a family of noted performers on the turf. Then select mares that are sound, healthy, large-bodied, capacious in trunk, and who yield a large quantity of milk; in other words, who are good nurses; due care should be given in the selection of mares, as they contribute more to stature and constitution than the sire. I prefer the heavy-bodied mare, 15 hands 1 inch to 15½ hands in height.

The stallion and mare should be mated, with a view to the difference in blood, and to correct any defect in form that may exist in the one or the other, in order to attain the best results. The mare, after being stinted to the horse, should be tried every tenth day for sixty consecutive days, or until she goes out of season, keeping her in a quiet place until she has conceived. The period of gestation, for a mare, is about eleven calendar months and nine days. While carrying the foal, the mare should be provided with a comfortable paddock, or four or five mares to a six or eight acre paddock, with a good shelter or box stall (14 by 16 feet), and given a liberal supply of sound Indian corn, oats, or barley, and good timothy hay, having access to pure water; she should be permitted to run out in paddock in all weather that is suitable, and confined in stall when the weather is cold or disagreeable, especially a damp cold; a clear, dry cold it is better for the mare to run. The strength of the foal, and subsequent usefulness and size of the horse depends largely, in my opinion, on the care and attention bestowed on the dam while carrying the foal.

About the time when you suppose the mare will bring forth her colt, she should be carefully attended by a competent stud-groom, who can assist her if anything wrong takes place. The mare should never be permitted to foal in a paddock that has running water in it, as she will certainly go to water after her delivery (she being feverish), the young foal will follow, and I have known them, when staggering about like a drunken man, fall into running water of the depth of three inches and be drowned. As soon as foal is dropped, the breeder should record the date of foaling, the sire, dam, the sex, and color, and the markings, with minute care. The foal should be gently and tenderly handled for the first eight days, until it will come and lick salt from the hand, and the mare should not be permitted to go out where the foal can lay down on the damp, cold ground, until it is four or five days old. The foal should run with its dam until weaning time; say, if foaled in the spring, until middle of October or 1st November; the foal should be fed with good oats or ground barley from the time it is two months old (a pen at the end of the trough, where the mares are fed, should be made for the purpose of feeding the young things, so that the mares cannot interfere with them when feeding). The *modus operandi* of weaning the colt (which we do at any time from middle of October to middle of November, in Tennesssee), is to bring the dam with its foal to the stall which the foal is to occupy (usually 10 by 12 feet). The foal is placed next to one of the sides of the stall, and the dam is held by two men against the foal, when the stud-groom passes under the neck of the mare and places the halter over the colt's head and buckles it on. By this process the first lesson is given quickly, quietly, and gently; the foal can neither go backwards or lunge forward, and can only dodge its head a little. After haltering fix a strong plow-line cord, 7 or 8 feet in length, to the ring of halter, and throw the cord upon the ground or floor; this serves the double purpose of catching the foal easily when you enter the stall, by taking up quietly the end of cord; also serves to teach the colt to stop when it steps on the cord, and gives it the first lesson in obeying the check; then let the colt remain in the stall three or four days before leading out into the stable-yard, giving it one or two lessons each day in the stable, by pulling the cord and turning it about; after three or four days, when it has forgotten its dam somewhat, fasten an extra length of cord, making 15 or 20 feet, and lead out, having a man in rear of the colt to motion at it, with whip to drive it along; walk it about quietly for ten or fifteen minutes (the first lesson), give a bunch of green grass, and return it to stall; continue this lesson from day to day until they are gentle enough to turn out in paddock and catch up handily.

Barley paddocks should be provided, and in all suitable weather the weanlings should be out in paddocks—the colts separated from the fillies when foals are weaned. The udder of mare should be bathed in camphor dissolved in alcohol, and then well greased with lard. The mare should be closely noticed, after being turned away, to see that fever does not set in the udder. Each weanling should be provided with a well-ventilated box-stall (ten or twelve feet), and fed thrice every day when stabled or twice a day when running on barley paddock, mixing a little bran now and then with their oats or giving a mash to keep the body in proper state. In the spring the addition of a tablespoonful of ground flaxseed two or three times a week in a mash is very beneficial. Keep their stalls well cleansed, with good straw (wheat or oats) bedding. In one corner of feed-box keep a small box supplied with salt and hickory or cob ashes mixed, as the salt causes them to eat more hay, and this causes full bodies and proper shape of ribs. The weanling should be stalled every night through the winter. My plan of grooming the young animals (which I begin about 1st of April, preparatory to annual sale about May 1) is to place a ring at either side of the stall, about midway the side

of stall; then have a stout cord, with snaps in both ends (this cord must be long enough to be a little slack when the snaps are fastened into the rings); pass this cord through the halter-ring of colt, and fasten snaps into the rings in side of stalls. The colt can slide along the cord, and as it yields somewhat to him it prevents the attempt to rear, which he would do if too unyielding. This arrangement—an invention of my own so far as I am advised—saves the expense of a hand when cleaning off the colts. The best mode for the breeder to dispose of them is to have an annual sale at some date between 1st of May and 1st of June of each year, and dispose of his entire produce without reservation or exception, and no by-bidding, at public outcry for cash.

The stallions should each have a paddock of one or two acres, well set in grass, and the exception should be to confine them to the stable; never have them shod unless you are using for saddle; a plenty of exercise and running out is the health of the stallion, enabling him to get stronger and better produce.

I offer here a few general remarks, by way of summary, on the art of breeding.

It is unreasonable to expect that our endeavors will, in every instance, be crowned with success. Perseverance seldom fails.

The breeder who selects his stallions with peculiar care, nice discrimination, and particular regard to pedigree, justness of proportion, size, powers, temper, constitution, and the essential qualities of speed and bottom, at the same time crossing the blood of his mares judiciously, endeavoring also to remedy the personal defects, deficient properties, and inferior qualities of the mare, by the beauty, admirable properties, and brilliant qualities of the horse, or *vice versa*, will be more likely to succeed in producing a beautiful and unexceptionable race of horses than the person who pays little or no attention to all or any of the particulars I have enumerated.

The breeder of any description of domestic animal must possess a thorough knowledge of the species of stock he is breeding, a decided taste and fancy for it, and a discriminating judgment. He must in the stock business, as in agriculture, be a student in all things that pertain to it, otherwise he will surely fail to accomplish the highest results attainable.

It is the interest of every breeder in forming a stud to purchase such mares as are free from all hereditary infirmities and have produced winners; and to select stallions which not only are of acknowledged celebrity on the turf, but which have proved themselves good stock getters. Speculative experiments may suit gentlemen of large fortunes, but the judicious breeder, aware of the expense which might be incurred, confines himself to the established practice of men whose experience and success in breeding render them worthy of imitation.

England has long been regarded as the nursery of the thoroughbred horse, but it must be gratifying to every American to know that our own country, through her plucky representatives, Mr. Pierre Lorillard and Mr. James R. Keene, have wrested from her the palm of excellence and superiority for 1881, and I may here add that European people are fast learning that America and Americans are irrepressible and invincible in all things that make a nation and people great, accomplished, happy, and that tends to individual prosperity.

In conclusion, permit me to state that a more suitable country than Tennessee is not to be found on the face of the habitable globe for the rearing of the blood-horse or any other breed of domestic animals. Indeed, Tennessee seems peculiarly calculated and adapted to the purpose of breeding and training horses for racing or the sports of the field; the purity, elasticity, and salubrity of the air, arising from its free circulation, the temperature of the climate being about the same latitude as his native country, Arabia and the Barbary States (36° to 37°), the luxuriance, sweetness, and variety of the herbage, the excellence of the water, quality of the grain, varied and diversified face of the country, short and mild winters, neither too cold nor too hot, are benefits which few other States or countries afford in an equal degree.

The PRESIDENT. The questions presented in the admirable paper to which you have just listened are now open for debate.

This paper, as you all know, was upon the "Blood-Horse," and is really an introductory to the whole question of horse-breeding in this country. Now, it certainly would be unwise in a convention like this—a convention of Americans—to stop short and deal with nothing but the blood-horse—an animal which is the result of importations into this country through a long series of years. As you have learned from this admirable essay, the ramifications of the blood of the blood-horse, in the various channels, are as important as that of the introduction of the horse himself.

Let me for a moment call General Jackson's attention to one point with regard to the horse with which he has been dealing, and I think

it is proper to say it here, because it is a matter which should never be forgotten by those who are interested in breeding. What is called the blood-horse is known as a thoroughbred horse, and the term thoroughbred applies to no living animal except the horse. I hear gentlemen talking about thoroughbred Short-horns, thoroughbred Ayrshires, and thoroughbred Jerseys and Devons, and after the most careful investigation I have satisfied my mind that the term applies to horses alone, and constitutes a breed of horses which has descended from a family known as thoroughbreds, and are just as distinct as the Clydesdales, or any other breeds which have been kept distinct for centuries. The term thoroughbred is exactly like the term Norman or Percheron. But when you undertake to say that you have a thoroughbred Jersey, you simply misapply the term, and use the name of a race of horses to describe your cattle. You may have pure bred Jerseys and short-horns, but when you have a short-horn bull every breeder takes it for granted that that bull is recorded in the herd book, which ought to be an indication that there is little doubt about his breeding. I state this simply because I have ascertained from the best authority that this is right, and I am very anxious to see these terms as accurately used in our country as they are in foreign countries. Have, then, on our lists and programmes of agricultural societies no more thoroughbred Jerseys, for there are no such things on earth. Let it be Devons, or Jerseys, or Ayrshires, or Short-horns, and take it for granted that every honest American that brings his animals to the farm has back of the name a record in the herd book, and can show that, and let that be sufficient.

General Jackson has stated very properly that there is no such thing as a horse of all work; and yet there is a horse in this country so compact, so firm, so well-balanced, so wise, so sagacious that he constitutes for the farm what may be termed a horse of all work. True, he has not the qualities that have been inherited through long generations from animals that were high bred, but he belongs to a family that for generations has been toiling along side by side with his industrious and independent master until, like him, he has become a part and parcel of the great American industry. The American horse is really the most sagacious and well-balanced of animals; there is no violence or impatience about him; he stands until he is told to start. If he will not, he does not belong to that family which I am describing. While to that race which manifest their desire to start, the horse that you cannot hold when his head is turned in the direction he is to run, the horse that possesses the resolute determination to arrive first at the goal, is the thoroughbred, and this constitutes his value; whereas it is the mild eye, the perfect quietness, and deliberate action of the American horse that constitute his true value. Every man who understands how to break a horse knows that the first thing necessary to teach him is to stay where he places him until he orders him to go on.

This American horse, which is really a horse of all work, is not remarkable for his size, but for his intelligence and capacity and his strength, which is astonishing. The Scotchman breeds his Clydesdale for the heavy draft of the London streets. The Frenchman breeds his Percherons for the same purpose, and for hauling heavy omnibuses along the highways of France. They constitute very powerful and valuable breeds of horses, but I can take you into New Hampshire, Maine, Ohio, Pennsylvania, Michigan, and all along the northern line and find horses of smaller size whose vigorous organizations give them strength equal to that of their more ponderous brethren. It is not the size of

a horse any more than it is the size of a man which constitutes his strength. It is not the size that constitutes strength, but the well-balanced, uniform, muscular animal organization, which, when called upon, knows where to apply strength. There was a small horse brought into the State of Vermont about a century ago, known as Justin Morgan, a fair type of the American. He was small. I doubt whether he was over fourteen hands and an inch high, and he never weighed over 900 pounds, and that was the horse which laid the foundation of that powerful race to which I have alluded. The holiday business of that horse was to compete in trials of strength at a dead-pull, and he could out pull any horse in the State of Vermont. It was that wonderful balance of power that gave him his strength. This is the style of horse that goes on hour after hour, in summer's sun and winter's cold, day and night, and is never weary. He is a good horse for the family. He knows exactly what he is expected to do, because for generations he has been engaged in that business to which Americans have applied him. It has been truthfully said that the American people use more horses than any other people on earth.

Every gentleman wants a horse for his family, and therefore wants one upon which he can rely. The American community is not a walking nor a riding but a driving community. They have used the horse in this way until he has inherited certain instinctive faculties which make him as easily taught as the American boy himself. Take the horse which has plowed all the morning and taken the family to drive in the afternoon, and you will find he has inherited for generations all that solid common sense which a horse will get as well as a man if he is taught; and there is no more trouble in breaking such a colt than there is in disciplining an intelligent boy. I have seen hundreds of these horses harnessed for the first time, and take to it as naturally as to the first quart of oats fed to them. That is the difference between the American horse and other horses that are not taught and used as he is.

As a member of this family there is that powerful animal known as the American trotting horse. He is not valuable because of his achievements on the track alone, but for all those qualities which make a horse useful and reliable. The trotting horse must be as steady on the track as the driver, and perhaps a little more honest. [Laughter.] He must know precisely how to manage himself, and must be possessed of all those muscular powers, that determination and will and deliberation which enable him to succeed under all adverse circumstances. I have seen many a trotting horse fail utterly on the track, because his disposition was unfit for the struggle there. He was, perhaps, hot tempered, impatient under restraint, unwilling to contend inch by inch in the hardest possible way for the victory. We have a horse bred for the track, and when so bred he inherits all the traits valuable in a farm horse.

Mr. Jefferson said, and I wish that General Jackson had alluded to it, that the long stride of the thoroughbred would be felt at the plow on a long summer day. So, I say that the steady, even gait of the trotting horse, which our English and French friends recognize when they come to this country—that long, springing stride makes him good on the road, and one of the best work horses on earth.

Now, if you will examine the origin of the American trotting horse you will find that while the blood, wind, nerve, and strength of the thoroughbred horse lies at the foundation, it is the French blood that

gives him his speed and stride. I suppose that to-day the best families of trotting horses are north of the latitude of Washington.

Some of the descendants of the best families of trotting horses south of the Ohio River can be found in Tennessee and Kentucky. The whole family of Pilots sprung from a horse known as Pilot, jr., a horse which has the reputation of having produced a large family of fast trotting horses; and Pilot, jr., was a Canadian horse. The Clays, another family of trotters, are descended from Surry, a mare that was sent from Canada into New Jersey. If you will examine the fine form and movement of the American trotter, you will see that it was the French blood that gave them their stride on the track, and the thorough blood that gave them their spirit and endurance. Unite the stride of the Canadian with the wind of the thoroughbred, and you will have the most powerful horse on earth.

I make these suggestions with regard to the trotting horse because he is entitled to consideration here, as a fine type of the family to which he belongs.

What General Jackson has said about the management of colts should not be forgotten. There are thousands of horses and foals wasted annually by neglect. We could raise a great additional number of good horses if the proper care were bestowed upon the foals and colts. The value of a horse bought in a Western market would be largely increased if treated with more care under the rule General Jackson lays down. Take a car-load of horses from the Western farms, shipped before they have any knowledge of their work. They are all fed to great proportions, and before they have attained their full strength they are sent to market, assigned to work, and six out of ten are ruined in early life.

The breeding of many of these horses is admirable. Improved as they are by the admixture of Percheron and Clydesdale blood, they will undoubtedly be modified by climate and improved by the American breeding, until in the end they will constitute some of the best horses we have. Among them are American horses bred out of this admixture with the North American blood, and I think they will be so developed as to furnish us with some of our finest carriage-horses.

I trust I shall be excused for occupying so much of the time of the convention, and I shall listen with pleasure to the discussion.

General JACKSON. I am very glad we are on so broad a ground. I rise simply to correct an erroneous impression as regards the violent temper of the thoroughbred. While a spirited animal, as stated in my address, I have always found them the most sensible animals.

I have driven to my carriage a pair as gentle as any horses I ever used, and have seen them subjected to the most severe tests—in one case to the sight of a bull calf, with a tin-pail tied to his tail, coming down the street, bleating at every step.

The PRESIDENT. I did not mean that they were violent in their temper, only that they were impetuous.

General JACKSON. I accept the explanation of our worthy president, and agree with him in the facts he has stated with regard to their adaptability for driving horses. I do not claim that they are the best animal for driving. I agree in the views expressed by the honorable Commissioner, that these horses are most too impetuous for driving horses; therefore, the English have the correct view on this subject, even for their saddle-horses—a three-quarter blood-horse. These are the horses we have in the South for saddle-horses. I will state that much depends upon the training of the animal. You have doubtless observed where the deficiency or difficulty is. When the thoroughbred

is heated on the race-course, driven back and forth before the heat, he has been given too much work, and when brought up there is an indisposition and fretfulness at the starting point; but show me the animal that has been carefully and properly handled upon the track, and how differently he approaches it, and how quickly he shows the result of proper care.

Dr. LORING. Have not those horses been the most successful on the race track?

General JACKSON. Yes, sir; let me see the animal controlled by excitement, starting, and exhibiting a kind of shakiness, and I know that that horse cannot win a race or a heat. What wins is a quick, well mannered horse that moves in a quiet way making no pretensions; that is the dangerous horse. I have seen a horse awaiting the start not moving from his position, not casting his eye either to the right or the left, and moving up quietly and off at the tap of the drum and not before. There is a great deal in the training of the horse. I feel that this was the case with the horses got by Missouri. He did not produce the best racers, and I believe that the produce derived much of their nervous disposition and their fine knee action from him, and this has made them such valuable trotting horses. There is no gentleman who admires the American horse more than I do; but it is a cross of the thoroughbred stallion upon the trotting mare that influences that blood in the produce, which is so much needed to quiet the temper of the animal, and give that knee action indispensable to the trotting horse. That is the true course in my opinion. So far, we agree in that idea. I have most valuable strains of it. The blood of that strain we have in my country, we date back to the American horse, Pilot junior. I prefer myself for driving while not wanting so much speed, an easy gait; 2.40 suits me. I do not care so much for speed. I prefer a little more beauty in my driving horse. I drive a three-quarter bred horse, a gentle animal, having a speed of about 2.40; if he was to see a locomotive standing in the road he would not fear it. He is spirited, but yet gentle. These horses have more of the motion of the roadster in my opinion than any others.

I value highly the American horse, but I do not like them for the track. I want a short clipping motion, which never produces the oscillatory motion in the buggy like that of a bucket swinging in a well, but like that which the locomotive gives to the train. Any length of stride that swings you in the buggy or gives a side motion to the buggy, is very repugnant indeed to me. But I want a driving horse with a motion like that of the locomotive. I have found, as I have stated, that the cross with the thoroughbred produces a roadster having a much preferable gait to the trotting horse. I am gratified to know that we have a distinct breed of American horses. They are very useful, but I still doubt the correctness of the claim that the American horse is of more value for a greater variety of uses than the thoroughbred. Most of our people who have horses will tell you that the blooded horse makes the best plow horse, the best child's pony, the best harness horse, and the best horse of all work.

The PRESIDENT. I have not forgotten the value of the thoroughbred, and know what a fine work he performs, and that but for the early introduction of such strains of blood as that from Messenger we should never have had these valuable animals, which have elevated our horses to so high a position on the race course. I have alluded to the old horse Messenger, and I could show further, that when brought into Pennsylvania he produced no trotters who became fine racers, but when removed to Long Island, and along the northern line where French

blood was found, he laid the foundation of the most remarkable trotting horses that have ever been in this country, and that is the value I place upon this blood.

Mr. SAUNDERS, of Illinois, said: I desire to speak briefly in reference to one point you raise in your remarks. It has been very common in this country to ascribe all trotting excellence of our American horses to one single thoroughbred horse, the Messenger. In writing a good deal on that subject I have become most thoroughly convinced of one point, to which you have alluded, and that is that the outcross of French-Canadian blood, wherever used with thoroughbred strain in our country, has always produced the best quality of trotting horses, and I attribute it to this mixture. It is this same French strain and mingling which produced Morgan and Pilot and Copper Bottom. The mare Surry was an outcross on Henry Clay. We found no trotting excellence in Kentucky until they obtained it from the Pilots and Copper Bottoms. In reference to the term thoroughbred I must beg leave to differ slightly upon that point. I believe that all good horses are entitled to the term, but it has become quite common, even in England, to use it in other connections. Its use during the past ten or twelve years has increased wonderfully. You will find it in the best papers in England. Language changes as we advance in civilization, and it is now common to use the term thoroughbred as synonymous with purely bred. You will find it in the very best English papers—the Mark Lane Express, English Agricultural Gazette—the terms thoroughbred Jerseys, Devons, and Ayrshires. As a rule it may be well to confine the term to horses, because it is the name of a breed of horses, and never should be applied to horses excepting "blood-horses," but, as I say, it is used as synonymous with purely bred.

The PRESIDENT. I had occasion once to define the name thoroughbred, and my impression is I consulted a book known as "Stonehenge on the Horse," for my information. I am perfectly aware that the practice is usually as Mr. Saunders says, and I think it would be a good example to set our English neighbors, and a very good way of helping them to realize that we understand ourselves as well as they do, to let the thoroughbred horse go for a breed of horses, and wherever the name Ayrshire or Jersey is applied, use it as such. If necessary to magnify it put "pure blood" at the head of it.

General JACKSON said: I do not wish to trespass on the time of others, but I would like to say one word about your reference to George Wilkes. When in Kentucky, he was regarded as a failure. I would state that in breeding the blood-horse, that it has been found, and England herself has come to the same conclusion, that this blood is impaired in the different sections of the country by breeding too closely in-and-in. There is the trouble, and the judicious crossing of the trotting horse and the other is very necessary. Take the thoroughbred Lexington. He was a successful horse on the turf, but in England was regarded as a failure, yet now has a peerless representation, and he got as valuable colts as any horse imported. Numerous instances show that it is dangerous to keep the same stock without bringing in a dangerous tendency.

The PRESIDENT. I am very happy to have been able to give General Jackson the floor first this morning, on account of the importance of the subject of which he was to speak. I feel compelled, however, to suggest that there are two or three other essays to be read and discussed, especially a valuable article by Mr. Morrow. Shall the convention hear the essay of Mr. Morrow?

Mr. SARGENT. There is upon the table a report of a special committee. I move that it be taken up.

The PRESIDENT. The report of the committee charged with the consideration of the question of co-operative experiments will now be read.

The report was read, as follows:

The committee charged with consideration and report upon co-operation in agricultural experiments having deliberated upon the papers which introduced the subject to this convention, and the discussion which resulted, respectfully submit the following report:

The value of agricultural research and experiment in America is fully admitted, and the extension of this work is recognized. With this growth arises the liability of a waste of time and materials through unintentional duplication of experiments by different parties, or such difference in details by those conducting similar lines of investigation, as to prevent satisfactory comparison of results, and the great need in other cases of conducting certain experiments in different localities upon a common plan.

Evils may be avoided on the one hand, and benefits secured on the other by the inauguration of some system of co-operation.

As a guide to these labors, comparatively new to our country, many institutions ready to participate need concise information, not now within their reach, as to similar experimentation abroad, and its results. It is therefore suggested by this convention, through the adoption of this report, that the United States Department of Agriculture may perform a service of great value in promoting the science and practice of agriculture in this country, by an effort to meet these wants. To be more specific, it is suggested—

1st. That the Department of Agriculture might furnish to all engaged in agricultural experimentation in America a well prepared digest of the work of this character, accomplished at the best stations of foreign countries, either as a part of the annual report, or, preferably, in a separate and earlier publication.

2d. That the Department of Agriculture might take measures to become the medium of communication between all parties engaged in systematic agricultural experimentation in this country, and endeavor to secure general co-operation in this work, especially the prosecution of certain important investigations in a number of different localities after a carefully prepared plan. Some of the questions suggested as of special interest, and to which general attention has already been directed, are the following:

The nitrogen supply of plants.

The various compounds of phosphoric acid.

The composition, nutritive value, and adulteration of foods.

These are in the line of exact science, and as practical tests.

The economic preparation and feeding value of ensilage.

The improvement of land by the plowing under of vegetable matters.

The adaptation of useful plants to arid regions.

3d. That the Department of Agriculture, acting for this convention, be requested to bring this important subject to the attention of Congress, and apply to that honorable body for the necessary means to carry out these suggestions, including such aid as it may seem best for this department to extend to those now unable, for want of funds, to engage in this work.

The suggestions of this report are not intended to conflict in any way with the independent action of institutions prosecuting work of this character.

J. M. McBOYD,
University of Tennessee.
G. C. CALDWELL,
Cornell University, New York.
W. O. ATWATER,
Connecticut Board of Agriculture.
A. A. SARGENT,
California State Board of Agriculture.
HENRY E. ALVORD,
Houghton Farm, New York.

The PRESIDENT. The chair desires to say that every suggestion made here is in entire accord with the wishes of the department, and are in the line of some inquiries made by the department which have been successfully instituted. Under the available appropriation an expert has been sent to Europe to examine experimental stations, the report upon which will soon be submitted. I assure the convention that

in so far as I am supported by Congress everything possible shall be done by the department to bring the reports of the colleges into immediate connection, in order to give the country the valuable information obtained therefrom. I am especially anxious to do this, and it is gratifying to know that the colleges themselves are willing to co-operate with me.

Mr. SARGENT. I would like to say, in behalf of the committee, that we were well aware of the enlightened labors of the present Commissioner, and our efforts in preparing the report to carry out the objects of this assembly was to strengthen the Commissioner's hands, and by our indorsement, if it were necessary, show to Congress that we do consider his labors as enlightened, and thus fortify him in his request for appropriations.

The report was adopted.

The PRESIDENT. There is a special committee ready to report, and as it will consume but a moment, the convention will receive it now.

The report was read, as follows:

The committee to whom was referred the request of General Ruggles to take into consideration a process invented by him "of composting manures and fertilizers by steam for agricultural uses," "and to report whether, in their opinion, it would be advisable that the subject be experimented upon by agricultural colleges as a basis of instruction in the interest of agriculture," beg leave to submit the following report:

That they find by consulting the circular of the inventor that the process has been patented, and that it cannot, therefore, with propriety, be considered or recommended by this convention.

D. B. GILLHAM.
JNO. L. BUCHANAN.
HENRY CLARK.
D. WYATT AIKEN.

The PRESIDENT. The convention will now listen to an essay by Professor Morrow upon the "Animal Industry of the Central West."

ANIMAL HUSBANDRY IN THE CENTRAL WEST.

BY G. E. MORROW, *Professor of Agriculture, Illinois Industrial University.*

To include a vast territory under the term Central West—even from Ohio to Kansas, or Nebraska, with the southern boundary cutting off not more than a single tier of States—will not be considered inappropriate when we bear in mind the magnificent extent of our national domain. In this region animal husbandry—the breeding, rearing, feeding of live-stock and the production of live-stock products—is already one of the most important branches of agriculture, and is to become vastly more important in the years to come.

Almost all the reasons which make the domesticated animal so important a factor in nearly all successful agriculture are applicable to the agriculture of this region. Here, as elsewhere, the farmer finds in stock raising the opportunity for profitable labor and oversight throughout the year; the most practicable means of preventing the waste of land and partial waste of by-products almost irreparable from most classes of exclusive plant cultivation. He finds in it the most effective prevention of deterioration of the fertility of the soil. His animals enable him to retain on the farm a large part of all his plant crops have taken from the soil. Their presence makes it his interest to adopt a beneficial rotation of crops, and to cultivate those best entitled to the name restorative as contrasted with exhaustive. They enable him to produce on his own farm a fertilizer unequaled in its wide application by any product of the skill of the chemist—barn-yard-manure—the best type of a complete fertilizer yet produced. During a good part of the year, his animals do what no other fertilizer manufacturers propose; they not only manufacture the manure, but apply it in a satisfactory manner to the soil where needed, making no charge for the labor, and doing full work in the manufacture of valuable products for sale. They enable the farmer to secure larger returns, and, probably, greater profits from a given area of land as the result of the greater labor and skill which they and their products require, as contrasted with grain-growing. Animal products are, in condensed form, valuable in proportion to bulk hence are better fitted for transportation to distant markets than are the more bulky

grain products. This condensation of the surplus farm products is one of the best safeguards against great loss from excessive transportation charges.

All these reasons apply with especial force to the agriculture of a nation like our own, which must necessarily be a large exporter of agricultural products. To no part of the country are they more applicable than to the Central West, which is to furnish the greater part of the agricultural material for export, and, in the near future, is to supply much food to the thickly populated East. With a soil admirably adapted to the economical production of grains and grasses, and a climate well suited to the healthful and luxuriant growth of both plants and animals, the Central West has laid upon it the desirablity of condensing agricultural products because of the great distance of the markets to which they go.

It is pardonable pride with which we speak of the marvelous rapidity of advance of American agriculture. The exportation of agricultural products may be said to have begun within the memory of men now living. The magnitude of these exports we can scarcely realize. Rapidly as they are increasing, the exportation of live-stock products is increasing, perhaps, most rapidly of all. We are to send largely increased supplies of breadstuffs to Europe; but the increase in the quantity of our animal product exportation is to be still more rapid.

Probably, in no country and in no age has there been equally rapid advance in agriculture with that seen in Western States within the last quarter or third of a century. Within a few years, States have grown from sparsely settled regions barely supplying the wants of the few inhabitants, to be mighty empires in population and producing power; and in no field has the development and improvement been more rapid than in the live-stock interests.

To one who had the pleasure and profit of studying the largest collection of fine farm animals ever made in Great Britain; whose admiration for the mother country swelled within him as he carefully examined the imposing array of animals shown at London in 1879, and who also looked at corresponding collections at exhibitions in our Western States a few months ago, there came the conviction that, as a whole, the American exhibits were better than the British; for not only had American importers secured leading prize-winning animals from Great Britain, France, and Holland, but, side by side with them were American bred animals, their full equals in many classes, and in some cases their superiors.

Not to unduly extol one portion of our common country over another, but because it was in accordance with the plans of nature, the belief is stated that the Central West is to be, for years to come, the region in which is to be produced the greatest number of high class farm animals of most classes.

The vast importance of the live-stock interests of the farther West, Southwest, and Northwest, is fully recognized. But until existing conditions are changed it is evident that quantity rather than high quality most characterize the animal products of these regions. The stock-breeders of the father West will continue to look to the Central West as the nursery ground from which must come the chief supply of high-class breeding animals as a means to the gradual improvement of their own stock.

Almost every section of our country may wisely give increased attention to some class of live-stock production. Especially would I be glad to see millions of acres of land, now almost unproductive, made the home of vast flocks of sheep, even if this led to the fine wool sheep being almost driven out of the Central West. Milk production must receive increased attention in the farming districts comparatively near the great center of population on the Atlantic coast. And I hope the time may soon be that our Southern States will have no need to import any live-stock products.

But in the greatest Indian corn producing region in the world; where also the forage grows thrice as well as anywhere in the United States; where the climate is alike free from excessive and long continued cold and dreary periods of oppressive heat; where the rainfall is usually frequent and plentiful, we have unequaled facilities for meat production, and all these facilities exist in much of the West. In the northern portion of the Central West there are districts far larger than all the dairy regions of New England and New York, which are almost unequaled for economical production of dairy goods. The present product of butter and cheese in the West is very large; the annual increase is great, and this increase is to continue for many years.

Much has been done in many ways to help the live-stock interests, but much remains to be done. In the work thus far done in agricultural experimentation in this country the soil and the plant have naturally had chief attention, but in breeding, rearing, feeding, and management in health and disease, of our domestic animals, many unsettled questions confront us, and for their solution we need the aid of the scientist, as well as that of the intelligent breeders.

If it be important to determine how best to utilize the food for plants found in the soil, none the less important is it to learn how most economically to utilize the plants as food for animals; if it be important to improve, modify, produce varieties of plants, so likewise of animals; if it be deserving of attention that better modes of manufacturing vegetable products be wrought out, equally true is it that like work needs to be

done for animal products; if the prevention and cure of diseases of plants be a worthy subject for patient investigation by the scientist, the suffering animal has at least equal claims to relief.

In these fields—not alone for the West but for the whole country—there is room for work by all whose attention can be enlisted. I am glad to know it is the purpose of the distinguished chief of the Department of Agriculture to give increased attention to these matters. It was a cause of regret to me that the discussion of the work of agricultural colleges left no time, in the convention preceding this, for even a word of recognition and commendation of the work already done in many lines by State and district agricultural societies. By their published reports and their annual exhibitions, these societies have done very much for agricultural progress. The growth of the American dairy system has been greatly assisted by the dairy associations. The agricultural exhibitions have been the most effective means ever devised for making the masses of farmers familiar with the various breeds of animals and causing the wide spread of the improved breeds throughout the country. Many of these societies are widening and making more effective their work. To the State board of agriculture of a Central West State, Illinois, belongs the credit of having instituted and placed on a secure basis the most instructive and interesting live-stock exhibition of the country, the annual fat stock show held at Chicago.

The fairs, special, agricultural, and general, has done good work in their lines, and is ready to do more. Many a farmer's boy has been incited to a desire for better live stock by what he has read in his agricultural paper.

Valuable experiments have been conducted or are now in progress at our agricultural colleges to determine unsettled questions in stock breeding and management. At the Illinois Industrial University, for instance, in continuation of work already done, lists of the comparative progress of cattle and pigs of all attainable breeds will be made.

The general government has given aid to special investigations of diseases, and has attempted legislation in aid of the live-stock interests. Except for a single animal product, American farmers have not asked for any other "protection" by law, than protection from disease, disease imported from foreign countries, from neighboring States, neighboring counties, or neighboring farms. No arbitrary or unnecessary restrictions are desired. Insisting that the herds of the Central West are free from contagious disease, it is asked that they may be permitted to remain so. I hope the time may soon come when all restrictions on importations from Great Britian may safely be removed, just as I hope we may soon be able to leave the British authorities without excuse for not removing all restrictions on exportations from this country.

Among vitally important questions to which too little attention has been given, may be named the adaptation of different parts of the country for the profitable production of different classes of animals and the comparative merits of different breeds for varying purposes and conditions.

Rich stores of valuable animals have been imported, but not enough attention has been given to distributing breeds with reference to their adaptation to special climates and conditions. It cannot be true that cattle from the plains of Holland, the Channel Islands, the south and the north of England, the lowlands and the highlands of Scotland, are equally well adapted for any one region, yet in some Western States there are enthusiastic breeders claiming special superiority for each one of these breeds. It is hardly in accordance with the self-assertion and confidence charged as characteristic of Americans, that we have not only been content to import foreign breeds, but, with rare exceptions, have held the types of those professed in their native lands to be the best for all our widely differing circumstances. Modification of breeds to meet special wants seems more needed than additions to the number of distinct breeds. Multiplication of breeds may be an evil. Certainly it is not sufficient reason for importing a breed to this country that it has been found useful or ornamental in another. For illustration, it is proposed to import to this country the West Highland cattle of Scotland. I have admired the picturesque appearance of these cattle in their native country; their stately horns, shaggy coats, as also their evident good meat; but I do not know where nor for what purpose they would prove more desirable in this country than breeds we already have.

I fully appreciate the heavy draught horses from Great Britain and France, but I do not believe the most popular types in those countries are the ones best fitted for the requirements of our own country. With hearty appreciation of the merit of the almost cosmopolitan short-horn, I cannot admit it is the best breed for all parts of the West. It seems quite possible it will be best to so modify some of the mutton breeds of sheep that the word American may as properly be prefixed to their names as it is to the Merino. Of swine, one of the very best breeds is the product of crosses and selection made in the West.

So, throughout the West, we need to better classify and distribute breeds. The central belt is admirably adapted to the production of the heavy draught and "the general purpose" horse; of the larger of the distinctive beef breeds; of the Downs and Combing wool sheep, and of the larger breeds of swine. The more northern belt is

naturally better fitted for the dairy breeds of cattle, especially those of northern origin for the lighter breeds of horses and sheep. In the southern portion will probably continue to be the chief center for production of the blood-horse, and perhaps of the trotting horse, while the meat-producing breeds will also thrive well.

There is a wide field for needed instruction concerning the characteristics of breeds, and the fundamental principles of breeding. It is unfortunately true that there are many American farmers to whom the principles of breeding and improvement of live stock are utterly unknown, and who use the term "improved stock" as an exact synonym for "fancy stock;" honestly believing that the improved breeds are of direct interest only to wealthy amateurs, or to speculators in agricultural matters.

To popularize the results attained by the most skillful breeders is a needed work. We may best do this by proving, in practice, that the so-called improved breeds deserve the title, because the produce for us, at equal or less cost, more or better meat, wool, milk, or work, than do the common breeds. In so far as we give chief attention to practically useful qualities rather than to those which simply appeal to the eye or to a sentiment, we aid in this work of popularizing fine stock.

In wise and ready adaptation of methods to the circumstances is found the secret of successful agriculture in any region. I grow more and more strongly to believe that the opinions and practice of intelligent and successful farmers are better adapted for their region and circumstances than are the opinions and practice of any other locality. It illy becomes us of the West to criticise the methods of the East, and possibly words of criticism of Western methods have been unwisely spoken or written by Eastern farmers. But the average farmer is overly conservative. He does not always quickly perceive the changing conditions which demand change of methods. It is important that this Department of Agriculture, the press, the agricultural societies, and the agricultural colleges help to the readiest appreciation of these changes.

In the West changes of conditions come with marvelous swiftness. The ruder, simpler methods of the past are often no longer applicable. The farmers of the Western States are in competition not only with those of the East, but with those of the civilized world. The enormous additions to the agricultural producing class each year is rapidly filling up the low-priced lands of the West. The rate of advance in price of land is less rapid as the money-value becomes larger; so that farmers in many parts of the West can no longer look to the rise in the selling value of their lands as the chief source of profit, but must look to profits from careful husbandry.

Greater economy of production, rather than the production of the greatest possible quantity, is coming to be the chief question for American farmers; and the more economical production of live-stock products is already in the front rank of the important problems confronting the farmers of the Central West.

Mr. JACKSON, referring to the point in the paper as to the danger of taking the teachings of one section of the country and applying them to another, stated that in his opinion the agricultural journals should be collated for the latitude they are designed to serve. While in one section the object is to make the most per acre, in others labor being the principal cost of production, and having an abundance of land, the object is to make the most per hand; therefore it is dangerous to apply the teachings of one section to another.

The PRESIDENT. The question is still open. The chair will state that in the last Congress appropriations were made in various ways for investigating all matters touching the diseases of cattle. A liberal sum was appropriated, and an efficient agent has been at work for the purpose of ascertaining whether any diseased animals had been shipped from this country to Europe. This department had a considerable amount of money, and their agent obtained full proof that no contagious *pleuro-pneumonia* had gone abroad. They have not modified their law, but their opinions, and the difficulty to obtain suitable legislation in Congress in this country is greatly enhanced by the number and variety of the constitutional questions involved in its consideration. My experience is that the members of the Senate and the House have been earnestly and liberally disposed to provide means to prevent the spread of such diseases in this country, and to remove the impression that they are neglectful of so important a matter, it is an act of justice that I should state that these are the views of some of the most efficient gentlemen in that body.

Dr. ELZEY, of Virginia, referred to the matter of transportation as dealt with in the paper, and expressed his surprise that they have in the Central West expostulation, legislation, and denunciation, as against railroads in that section. Twenty days previous he had been told by a proprietor of a feed-store in Alexandria that every article upon sale in his store, without an exception, came from the Central West because of the question of transportation; that transportation on those articles from Chicago to Alexandria was less than from 30 and 40 miles distance in the neighboring section of Virginia and Maryland. It costs 12 cents a bushel for wheat from Chicago to Liverpool. I live within twenty-six miles of Alexandria, and within four miles of the railroad depot, and 12 cents a bushel is what it costs me to send wheat to Alexandria. [Laughter.]

Dr. Elzey spoke of the difficulty surrounding the several industries, because of this question, and referred at length to the subject of fertilizers, and the exhaustion of the soil. He then dwelt at length upon the diseases of live stock, and the importance of action on the part of the department and Congress relative thereto, and closed by offering the following resolutions, and moved that a committee of five be appointed to present the same to Congress, and to report to the convention:

Resolved, That this convention, profoundly impressed with a sense of the danger which threatens one of the greatest of our agricultural interests, from the continued existence of lung plague or contagious pleuro-pneumonia of cattle in the District of Columbia and several States of the Union, do most earnestly and respectfully urge upon Congress that they will consider the propriety and necessity of national legislation in aid of such proper and effectual measures as those States, or any of them, may adopt for the complete suppression of this fatal distemper.

Resolved, That we do most earnestly and respectfully represent to Congress the urgent necessity for prompt and effectual measures for the complete suppression and extinction of this plague in the District of Columbia.

Resolved, That this convention are assured that the present status of this plague cannot be suffered long to continue without its becoming widely diffused and permanently naturalized here; and that such a result can only be viewed as a stupendous and far-reaching national calamity.

Mr. SAUNDERS. The question here is certainly one of great difficulty and of vital importance. There are one or two other points in the Morrow paper I would like to hear discussed, but I will move that as the hour has arrived for adjournment, that we now adjourn, and that will give us a little time to think of the resolution and continue the discussion of the question at the afternoon session.

The PRESIDENT. The chair would suggest that the logical order would be to let the resolution be adopted, and then you have something to go upon.

The resolution, as offered, was adopted.

The PRESIDENT. The chair will announce the committee at the afternoon session of the convention. The time has arrived for adjournment. At the afternoon session, the first essay should be presented by Mr. Campbell Brown, of Tennessee, on "Jersey Cattle."

Mr. JACKSON. I have been informed that Major Brown will not be able to attend the meeting.

The PRESIDENT. There is an announcement of an essay upon sheep, by Mr. Cockerill, of Tennessee. Will he be present?

Mr. JACKSON. I do not know.

The PRESIDENT. Then the essay will be that of Professor Law, on Veterinary Science.

The convention then took a recess until 2 p. m.

The convention was called to order at 2.20.

The president announced the following committee upon the resolutions offered by Mr. Elzey, viz: Messrs. Elzey, Law, Saunders, Morrow, and Aiken.

The PRESIDENT. The first business this afternoon is an essay upon Veterinary Science, by Professor Law, of Cornell University.

Professor LAW first referred to what veterinary science had already accomplished. Formerly Europe was devastated by rinderpest with a loss of 20 to 50 per cent. of cattle—in some places more, some less. Now, apart from general wars, it is virtually unknown in Western Europe. Formerly sheep-pox ravaged Europe generally, producing a mortality nearly equivalent to that of rinderpest among cattle. Now, by efforts of veterinary science it is little known out of the Russian steppes. Formerly lung plague was a constant menace in Central Europe—extending from the mountain ranges where different herds of cattle could mingle freely and perpetuate the contagion—now, comparatively, there is none apart from the great channels of trade and the gigantic feeding establishments.

Rinderpest was introduced into England in 1865, and increased owing to neglect of restrictive measures until 1866, when the attacks amounted to over 13,000 weekly. The disease was then taken hold of, active measures were introduced for stamping it out, and in a few weeks a very material and satisfactory reduction of the losses was manifest, and within a year it had virtually disappeared from the country. During this outbreak the losses were nearly $50,000,000. The year previous sheep-pox entered from Europe with some imported sheep. It was introduced upon the downs of the midland counties. It was at once arrested by prompt destruction of the sick in infected flocks, and there was saved at a small outlay a loss that might have aggregated $100,000,000.

Lung plague has cost England in forty years considerably more than $500,000,000—which might have been saved by application of proper measures at the early stages of the disease. The free trade in continental cattle has maintained this plague in England in the past, and even now when measures are being taken to suppress it these are too loose to afford protection at every point. While England shuts out all cattle from foreign countries infected with lung-plague, not admitting them even under quarantine regulations, she admits from infected Ireland cattle without question into her native herds. England affects to destroy all animals diseased, yet in case of animals in transit only the sick are slaughtered and those that have been in contact with the sick are allowed to pass on to their destination, and therefore England should not expect any extinction of the plague. She is simply adopting repressive measures. In connection with this loss we might consider the present agricultural depression. This is not mainly owing to cattle disease, yet contagious diseases in cattle did much to undermine this industry which has been now brought to the verge of ruin by American competition and unfavorable seasons. In contrast to this, Professor Law quoted the countries from which contagious pleuro-pneumonia had been stamped out—Norway, Sweden, Denmark, Switzerland, and others, and in our own country, Massachusetts and Connecticut. In connection with the former the speaker mentioned Dr. Loring and Dr. Thayer, and with the latter ex-Governor Hyde and Mr. Gold. This he considered triumphs of veterinary sanitary science.

Referring to anthrax—known under many different names—Professor Law said it was an infection shown by veterinary investigation to re-

side especially in swampy localities, river bottoms, and the like. It is especially a disease of close, impervious soils—of those that are rich from the amount of organic decomposition, although they are not so close in their texture; yet in their organic decomposition, whether from the vegetable products of the soil or heavy manuring. It is also found to a certain extent on "water-logged" soils. Anthrax is due to a microscopical parasite—the *Bacillus anthracis*—which bears a close resemblance to the *Bacillus subtilis* of old hay, but the *B. subtilis* introduced into the system did not produce any of the pathological effects of the *Bacillus anthracis;* yet investigations were set on foot to determine whether or not they were not the same. Dr. Greenfield, of London, made the first essay, and Buchner, following, demonstrated that the one could be transformed into the other by growth in particular media. These investigations suggest the possibility of harmless germs lying around here and everywhere being transformed under certain conditions of climate, moisture, &c., into those that are pathogenic; but on the other hand it suggests protective inoculation with the mitigated virus of anthrax to fortify the system against a second attack of this disease, as cow-pox proves protective against small-pox. By cultivating the germ of malignant anthrax in free air you obtain a germ the products of which are not deadly, or which cannot grow in the system with such vigor as to be in itself mortal to the subject inoculated. The germs that live in the animal tissues, or the blood, can only get a limited supply of oxygen, and feeding upon that become more and more accustomed to it, and therefore become more and more virulent, reproduce themselves in greater numbers until they become deadly poison, while originally they were comparatively harmless. Poison which has once grown in the animal system, man or beast, if transferred to another animal is immensely more potent than in the first. So we have an adaptation of poisons to the conditions of life in which it finds itself. At first it demanded a great supply of oxygen. It could not live, vigorously, away from it. Transfer it into the blood, and it maintains a somewhat sickly life, all the time acquiring, however, the habit of living with less and less oxygen. Transferred to another system it gains a little more. In the third still more, becoming all the time more and more deadly.

Professor Law described at some length the observations of Pasteur and Salmon in chicken cholera, and his own on hog cholera, all sustaining the same general principle that the *bacteria* of these diseases become more or less virulent, according as they have been previously grown in media approximating in composition and supply of oxygen to the conditions they meet with in the animal fluids and blood. Also the converse that these *bacteria* can be cultivated in such environments that their virulent properties are modified, and they produce only a mild and non-fatal disease, though still protective against a second attack of the same malady.

He proceeded to trace the operation of the same principle in the case of typhoid fever, the germs of which are most deadly if confined in an unventilated sewer or privy vault, if they leak into a close well or soak into a dense water-logged or filth-sodden soil, but are soon rendered harmless if thrown out in thin layers on the surface of the soil and in free air; also in the case of cholera, the germs of which are preserved indefinitely at a summer temperature in well-water, rivers, filth-saturated or sodden soil, and those with a high-water level, but are rendered completely harmless when exposed in thin layers to the air for a period of six days; also in yellow fever, the germs of which attain their most deadly potency when confined in closed ships' holds, or ships' wells

beneath the valves, in water-soaked and putrid soils, in sewers and stagnant ponds, whereas drainage and exposure to pure air puts an end to the virulence; also in the cases of diphtheria and croup, which prove more or less deadly according as the germs develop on the air-passages and in free air, or on the alimentary passages where the stagnant air, or the comparative absence of air, adapts the germs for survival or reproduction in the blood and animal tissues. The same holds in the case of septic poisoning, the putrid matters when inoculated producing oftentimes but a mild disease, but transferred from the first infected animal to a second the resulting disease proving much more severe, and if inoculated from the second infected animal on a third, and from the third on a fourth, it attains its most destructive potency only in the fourth or fifth system. Again, Grawitz has shown that several of our common molds, when grown under the surface of an organic infusion, are propagated in the form of simple cells only, and not as branching plants, and the isolated cells introduced subcutaneously into the animal system produce a fatal disorder. Underneath all is the general law that the growth of these low vegetable organisms—*bacteria* or *fungi*—in a limited amount of air, fits them to maintain a vigorous life in the animal fluids and to produce disorders more or less fatal in character. But the same law, working in a reverse direction and transferring the fatal virulent germs into a form which demands a liberal supply of air for their active life, and one unfitted for survival in the blood or tissues, furnishes us with a poison which may safely be inoculated, and which will fortify the system against any future attack of the same poison.

From the above premises Professor Law went on to draw the following deductions: That *bacteridian* disease-germs are preserved and their virulence intensified by close buildings, rotten wood-work, accumulated fodder, and other contents of the barn, overcrowding, close drains and sewers, cesspools, close spaces beneath stables into which liquid manure drops, close, undrained, non-aerated soils (clayey, hard-pan, water-logged, manure-laden), wells receiving surface drainage (especially covered wells in compact soils). That the same *bacteridian* disease-germs have their virulence, though not necessarily their vitality, destroyed in clean, airy buildings, on the surface, in free air, in open wells, ponds, and rivers, in chalky, gravelly, or other pervious soils when sufficiently dry, and in soils subjected to frequent plowing in connection with cultivated crops. In the case of graves, when the infected carcasses have been buried, it is imperative with certain of these diseases; such as anthrax, that they should be thoroughly fenced in for years.

Referring to lung plague of cattle, Professor Law set forth at length the relative advantages of dealing with this disease by protective inoculation, and by the more rigorous stamping out by slaughter and disinfection. Fully acknowledging the protective influence of inoculation, he showed the dangers when it was resorted to of extension of the disease by sound animals taking into their lungs the germs from the inoculation wound, either directly or after such matter had been dried up for a length of time in buildings, &c. He showed further that inoculation, never having proved effectual in permanently stamping out the lung plague in any country, situated as we are, we could only look upon it as a means of restraining the disease and mitigating the losses, while its extension to the sources of our cattle traffic, and its general diffusion, would remain possible at any time. Such extensions would demand the adoption of inoculation over the increasing area, every new herd in-

oculated becoming, for a time, with the buildings, &c., a new center of infection, the dangers of diffusion of the plague would be proportionately increased. Then the cost of inoculating over 40,000,000 cattle would cost not less than $4,000,000, while the half of that sum judiciously applied would extirpate the disease from the land, and free us from the danger, except from its reimportation. Inoculation would have to be repeated as often as new stock were introduced by birth or otherwise, whereas a complete stamping out would prove effectual for all future time.

He went on to state the difference of our relations to lung plague, and to the other contagious diseases of animals. Texas fever, anthrax, chicken cholera, and swine plague are already so widely spread in the United States, or so permanent in certain soils and districts that they cannot be approached with the same confidence of a speedy extinction as can lung plague. Again, several of these demand for their extinction such modifications of the soil by culture, drainage, and otherwise that the task of stamping them out would be a far more trying one than the extinction of lung plague. Lung plague, on the contrary, is confined to a very limited area, and apart from the infected cities to inclosed farms, from which it could be certainly and permanently crushed out. Lung plague now costs us $2,000,000 per annum on our exports alone, and probably a million more of incidental losses at home. No country invaded by this disease has ever been offered a fairer opportunity to stamp it out, and to no country will so much blame attach if it is allowed to spread until we count our losses by scores of millions in place of units.

On these considerations it appears highly important that Congress should be urged to grapple with the plague promptly and earnestly, and that whatever appropriation is made for the extinction of this affliction should be ample, and should be made applicable to this plague alone. If an attempt is made to deal at once with all our animal plagues any sum appropriated by Congress will soon be exhausted, the work will have to be stopped prematurely, and this and other plagues will be allowed to spread around. The prompt and thorough extermination of lung plague is demanded by considerations of political economy. Much less than our present yearly losses from this disease would suffice for its final extinction, and these bear no relation to the immense losses that must follow its general diffusion. The moral influence to be secured by the extinction of this plague is needed to incite Congress to advance to the extermination of our other animal plagues. On the contrary the initiation of work upon all the plagues of our live stock, and the failure to exterminate any one of them, until the time and means have been exhausted, will only serve to secure charges of no good results, denunciations of all kinds, and a hesitancy or refusal to proceed further in the matter. This is really what has happened already in several of our infected States. New York had stamped the lung plague out of six counties, and would have done so in all, but that local prejudices and politics in Brooklyn were allowed to set the State law and officials at defiance, and finally, when on the strength of a new appropriation preparations were being made to face and conquer the difficulties of the situation in that city, orders were received from Albany which virtually enjoined the cessation of all effective work, and since that the plague has spread in four counties which were virtually clear. Pennsylvania, which began well with a most liberal system of indemnity for animals killed, which enlisted the stock owners themselves in the interest of extinction, never succeeded in the essential measure of establishing separate markets for sound store cattle on the one hand, and suspected

and beef cattle on the other, and finally were compelled to reduce their indemnity and proceed under the same disadvantages as other States. In New Jersey, after a period of work, the pleuro-pneumonia law was abolished, and the whole matter put under the control of the State board of health with the utterly inadequate appropriation of $5,000 a year. The result has been that infected herds have been left to themselves without even visitation by State officials, until the plague had done its worst.

Governors and legislators seem to forget that the extinction of an animal plague is not a piece of work like the construction of a steam-engine, or a railroad, which can be taken up and laid aside in accordance with whim, caprice, or apparent necessity. The case, gentlemen, you can better appreciate as the counterpart of the neglect of weeds. The single thistle which you allow to grow to maturity scatters its thousands of seeds on the viewless winds, and increases the work proportionately for the future. Careless methods or intermittent work on these animal plagues is but prodigality of the public money and abuse of the public confidence. What is demanded is a well conceived system, rigidly and impartially carried out, until the last infected animal has been killed, and the last germ of infection has been destroyed.

I would therefore propose that a memorial be sent to Congress expressing the sense of this convention, as to the imperative necessity of prompt legislation and executive action on the lung plague, and to the need of a liberal appropriation to be employed for the extermination of this plague only until it shall have been completely annihilated.

Professor LAW. Referring to the efforts made in New York——

The President asked. I should like to ask, if you can tell us, how much it would cost to wipe out pleuro-pneumonia in the State of New York?

Professor LAW. It would be difficult to estimate this without knowing the precise limits of the disease at present, but I think that the money now appropriated in the State of New York—if it had been available with the proper power, at the commencement of 1880 when the work was virtually stopped, that is, if we could have stopped the movement in Brooklyn and suburbs, as we had in New York, I think that money would certainly have been enough.

The PRESIDENT. How much was it?

Professor LAW. Fifty thousand.

The PRESIDENT. Why was it stopped?

Professor LAW. I don't know.

The PRESIDENT. Whose officials were employed?

Professor LAW. State officials. The trouble was this, when the new appropriation was made I began at once to lay measures for increasing our staff to carry the war into Brooklyn and suburbs, the first and last home of the plague in the State, and I was met at once by an order from Albany to cut down the staff.

The PRESIDENT. This law of New York authorizes you to slaughter cattle and pay for them?

Professor LAW. Yes.

The PRESIDENT. To what extent were you obliged to reduce your staff?

Professor LAW. We had to dismiss two or three inspectors; I left at that time, feeling that my reputation was at stake, and that only discredit could come of my continuance.

The PRESIDENT. How many men did you employ?

Professor LAW. We had eight veterinarians regularly, and others were called in when occasion demanded. Beside these, were non-professional men as clerks, yard men, &c.

The PRESIDENT. How many cattle were destroyed and paid for at the time?

Professor LAW. Seven hundred and eighty-three cattle have been killed and paid for, some thousands more have been killed, as suspected, and used for beef.

The PRESIDENT. Was the attempt an expensive one?

Professor LAW. Indemnities amounted to $24,726.27.

The PRESIDENT. Were the funds exhausted when the work ceased?

Professor LAW. No.

The PRESIDENT. Why, then, did the work cease? What was the trouble?

Professor LAW. It didn't cease: only partially so.

The PRESIDENT. By order of the governor?

Professor LAW. Yes. The great desideratum from the beginning was the lack of power to control the movement of cattle in infected districts. I may illustrate by making a statement in this connection. In New York City no bovine animal was allowed to appear on the streets without a signed permit of the proper date, stating where it started from, destination, owner, &c., and giving so many hours for the journey. No animals were allowed to enter the city except in special cases, by permit, or through the bonded yard, into which these animals had to come by boat or rail from uninfected districts. The veterinarian had to be at the yard and examine every animal, and give certificates for each animal. Three months of this active work had nearly cleared the city. In Brooklyn no such control could be exercised, and the disease remained very prevalent.

The PRESIDENT. Where did these cattle come from?

Professor LAW. Western New York and the States of Michigan, Ohio, and Western Pennsylvania.

The PRESIDENT. They were put in these yards and there caught the disease?

Professor LAW. Not at all.

The PRESIDENT. Where did they get it?

Professor LAW. Their opportunities for contracting the disease began in Brooklyn, in the dealers' stables, where sick cows were sometimes temporarily accommodated; next in the infected dairies, to which they were sent; and finally, if they escaped both, on the infected lots on which they pastured in common with other herds.

Mr. SAUNDERS. I understood you to make the assertion, during the course of your remarks, that for $2,000,000 this disease could be exterminated. I would like to know whether you make that statement at random or as the result of actual estimation.

Mr. LAW. Judging from my estimate, and from my knowledge, I think it would probably cover the entire cost and leave a considerable margin.

The PRESIDENT. About how much did you say it would cost?

Mr. LAW. About $2,000,000.

Mr. SAUNDERS. How many millions, Mr. Law, would it take, in your judgment, to exterminate this in twelve months?

Mr. LAW. That is impossible to say. I cannot give an answer to that question. If twelve months hence finds it near the present area, it would probably be covered by the amount I name. If it were carried out West, no estimate can be made of its probable cost.

Mr. SAUNDERS. How many months would it take to exterminate it if carried West?

Mr. LAW. If carried west of the Alleghany Mountains there is no

telling to what extent it might reach. The danger of its being carried West is, in my opinion, increasing every day, and the danger is largely increased by sending large numbers of animals to the West. Formerly few cattle were sent West. Within three years there has started up a new trade—a trade which in the last fifteen months, up to the end of August last, had grown to large proportions. I was told that it had reached the enormous number of one and a half millions at Chicago alone. Another great danger is in sending thoroughbred cattle to the West. One danger is the great increase in the country in the number of imported animals, of short horns in particular, which have deteriorated so much that they have come down to a low price; and hence the demand for imported short-horns, to improve the present grade of cattle, is increasing.

Mr. SAUNDERS. About how many calves were raised in Chautauqua County this year?

Mr. LAW. About one-half million calves have gone into Chicago in the last six months, and of forty thousand, two-thirds have nominally gone from Chautauqua County. We think they probably came from farther off, though none of the men so reported them.

Mr. SAUNDERS. Is not feeding them on glucose slops one of the main causes that produce this disease?

Mr. LAW. No. I could give you some statistics in regard to that, but I have not the figures here with me, and so am compelled to speak in general terms. In the first place, where the cattle suffer so much from disease in the East, very few are fed on this kind of food. In the second place, in the West, where we have many factories, we have no disease, and in the West we find cattle living on similar products, the swill of distilleries, &c. We confine them in close buildings as well adapted to their health as in the East, but there has not been a single instance of this disease originating there. They ship these cattle all over the country, and I should judge the manner in which it is done is unhealthy. I think it is calculated to produce disease. This disease, as I have before said, came originally from a foreign country.

The PRESIDENT. I think an appeal to the States where this disease exists, through the executive authority, would produce a good effect. Professor Law has said that this disease could be removed by extirpation and by the employment of the processes resorted to in Massachusetts to get rid of it. I think that after I state precisely what was done in Massachusetts that any one can see what ought to be done elsewhere. I have no doubt the facts are familiar to most of the members of the convention, but I will briefly refer to it. In 1859 there were imported from Holland to Massachusetts some Dutch cattle, since called Holsteins. They were taken from Boston to their destination on wagons, because they were in such a condition that they could not travel on foot. Three of them died shortly after their arrival. Out of the herd there was a calf sent to the town of North Brookfield, in the county of Worcester, where the dairying business is conducted on a large scale. This animal went there about the month of November, 1859. In the winter it was discovered that the calf, as well as other cattle associated with it, were attacked by a disease which was soon ascertained to be contagious pleuro-pneumonia, the history of which was well known, and the remedy for which, in England, Holland, and South Africa, had been extirpation. Some working oxen engaged in moving a barn caught the disease from those of their number that had been exposed, and soon an area of ten miles square was found to be infected. The legislature was applied to by the agricultural board for some remedy. A commis-

sion was immediately appointed, and $125,000 were appropriated to extirpate the disease. As a member of that commission I assisted in isolating every case in the infected district. After isolation if a diseased animal was found, he was killed at once, and the infected herd with him. Not a case has been heard of in the State since. The remedy applied in Massachusetts can be applied everywhere.

Professor LAW. I think this disease is flourishing in this country and has for forty years, and so has kept our Eastern States in a constant state of infection, and will continue to do so until we stamp it out. I will allow this much to be true, that in winter it has not that deadly character which it has in other countries where, according to several eminent veterinarians, it destroys entire herds without exception, as in Brooklyn and New York, and therefore I think that if the proper steps are taken to prevent its introduction into this country that it will not propagate itself. It is now thought that the disease is not, in the heat of summer, as fatal as in Europe.

A MEMBER OF THE CONVENTION. Would it not flourish as well here as there if not exterminated?

Professor LAW. I think there is no remedy equal to extermination. If it go on it will largely concern the cattle traffic. In England it goes to the great ports and from them is spread all over the island. It has had no disposition to spread from where it originated, except in some cases, but wherever carried from infected animals it has spread as fatally as in England. If carried to the sources of this great traffic I do not think that even the high, clear air of the plains would prevent its rapid development, as it has in the steppes of Asia, or in Australia, where the climate is alleged to be one of the finest in the world for bronchial affections.

Mr. GILLHAM said he feared we were beginning to think that the disease could not spread. Professor Law had forcibly expressed the truth by saying that the current of trade is against it. He had had experience with the difficulties of the situation, and was glad to hear Mr. Aiken say that the Agricultural Committee of the House were going to investigate that question this session. Some think that the States might do everything, and others think they can do nothing. Now, if the States themselves would take hold and exterminate all the cattle in their respective States infected with this disease, that would simplify matters a great deal. We have seen that New York and Pennsylvania make little effort to check it—that Maryland has done little or nothing in this direction, and right under the shadow of Congress. It is useless to make the effort to prevent its spread, unless we can have some legislation on the part of Congress that will make it an object. The West realizes the very grave character of the danger threatening us. Its spread throughout the West would entail a loss of millions of cattle, and yet we are told that it will only require the expenditure of the pitiful sum of $2,000,000 to stamp it out, if what is called the best government the world ever saw would act promptly and efficiently. Illinois would spend that sum for such a purpose. That State recently passed a very stringent law prohibiting the importation of cattle, and while this checked the importation it cannot affect cattle in transit across the State. These cattle will stop at Galveston, at East Saint Louis, and are there penned. The legislature is powerless. If there is anything to reiterate it is what has been said by the chairman of this convention, for this convention can do something. Get this before Congress—get it before the States—get it before the efficient farmers in all the States, and that will give you a system of some account to stamp out

this disease. This department, whatever its sins in the past, could wipe them all out, if Congress were to aid it in the important work of averting this trouble, to which our people are looking forward with fear.

Mr. Gillham closed by advocating the adoption of resolutions by the convention expressing the sentiments relative to the extermination of this disease.

Dr. LORING explained a bill introduced during the last session of Congress, and said: The bill of course met with a good deal of opposition. There were certain constitutional questions raised with regard to the rights of the Federal Government in the States, and of Congress to appropriate money for such purposes. Meanwhile Congress adjourned and the matter was postponed. That bill is still in existence, and contains measures for the extirpation of this disease which would not only be effective, but the most thorough, accurate, and scientific. I think that these bills might be collected by a committee of three of this body, in order that we may understand what is now before Congress. Colonel Aiken will be happy, I doubt not, to assist. A strong statement of the whole matter could then be prepared setting forth to Senators and Representatives the need of this great and growing interest; and I move, therefore, that a committee of three be appointed for the purpose of securing all the bills that are now before the House, or that were before Congress at the last session.

Mr. SAUNDERS, of Illinois, heartily concurred in the motion made by Commissioner Loring, and gave an account of an interview with ex-Senator Kirkwood on yesterday with reference to this bill, and the reasons why it did not pass at the last session.

Mr. AIKEN and Commissioner Loring further explained reasons for non-action on the part of Congress.

Mr. SAUNDERS stated that any proper bill brought forward this session would have the support of the Speaker of the House.

The PRESIDENT *pro tem.* (Mr. BLOUNT). How shall the committee be appointed?

Commissioner LORING. I move that it be appointed by the chair.

A MEMBER. I move that the committee consist of the Commissioner of Agriculture and Messrs. Gillham and Aiken.

Dr. LORING. I wish to be excused. I will co-operate with the committee with great pleasure, but I think the committee should be composed of the delegates.

The following committee was then appointed: Messrs. Gillham, Meredith, and Law.

Colonel AIKEN referred to the remarkable fatality of cows taken from the North, and asked Professor Law why it was that if a grown bull or cow is taken where there is limestone water that certain death follows? There is no such effect produced on other stock. He had brought horses from Central New York and has had no trouble. We only have to preserve them through hot summers. I have brought sheep from Southern Ohio, and they have been very carefully raised, yet they lost all their wool.

A MEMBER OF THE CONVENTION. Were they Cotswolds?

Mr. AIKEN. No, sir; they take no Cotswolds to my State; they are thought to be too large.

A MEMBER. Have you taken any from Tennessee to South Carolina?

Mr. AIKEN. The finest I ever had were from Lexington. But referring to this fatality, I have known a magnificent cow bought in New York to die in three months after reaching Charleston.

Mr. JACKSON. What condition are they generally in?

Mr. AIKEN. In good condition—in the best possible condition. It is a question of great importance to us. We are all meeting with the same ill success. If I could get a satisfactory answer to the question I have asked I should take the privilege of publishing it. We believe that the Jersey cattle will find a better home in South Carolina and Georgia than anywhere else. They will fatten better and do better, I think, than they would in New England. We are very much interested in them, and all the people in my country are desirous of getting them.

A MEMBER. Is it near the coast where the gentleman lives?

Mr. AIKEN. I am not on the coast. My place has a fine location for cattle.

A MEMBER. How far does this condition of affairs extend beyond Carolina?

Mr. AIKEN. I have heard of the same thing in Georgia.

Mr. LAW. Does this locality not extend beyond South Carolina, toward the coast?

Mr. AIKEN. Yes, sir.

Mr. LAW. Must the calves be fed on milk?

Mr. AIKEN. No, sir; I have never fed them on milk. I have fed one on green food and a little meal.

Mr. LAW. Are there any trees in the pasture?

Mr. AIKEN. There are no trees.

Mr. LAW. What is the nature of the disease, if it can be made out?

Mr. AIKEN. That is a question I cannot answer. I remember distinctly that the cause of death of two fine heifers was, in my opinion, bloody murrain, but what caused the death of my Seneca Falls bull I did not know. He did not come up in the afternoon, and I found him lying on the ground as if asleep; he had something like *meningitis*. He died during the night, and one of the two that died later died in the same way.

Mr. LAW. Did you notice the carcass. Had it a yellowish hue?

Mr. AIKEN. The only thing I found in the way of discoloration was in the intestines, and these seemed to be congested.

Mr. LAW. And the coat of the stomach?

Mr. AIKEN. It was a good deal congested.

Mr. LAW. It is an understood and well established fact, that the Texas fever extends to North Carolina, and I would presume that this is the same thing that you describe.

Mr. AIKEN. Where would the Texas fever originate if I bought them in New York or Tennessee?

Mr. LAW. It has been planted there and extended from your native stock, though your native stock have now acquired immunity from it. Not only is this a general principle, but it is the case, with reference to certain diseases, and particularly anthrax, which is contracted in pregnancy. The germ of the disease has never yet been found in the uterus, but the chemical products have been.

The PRESIDENT. Let me say with regard to the Jerseys of the South, that I have found to my surprise that the Southern States seem to be the home of this breed of cattle. There have been a great many imported into Massachusetts, but in South Carolina last autumn I found them in fine condition, with heavy and strong muscles, well developed, and in a thrifty condition in every way. There is something in the climate of that section which is promotive of the health of a delicate and sensitive animal like the Jersey; on the other hand the short-horn does not

thrive well there, his physical organization being made up for the production of fat entirely, and not being suited to the oppressive heat of the Southern States. The delicate and smaller animals, however, find the South their natural home.

The difference between the physical organization of cattle for the dairy and for the production of beef is very great, and I hope to lay this matter before the convention more fully when the question of the dairy comes up, for I think I can account in a measure for the difficulty that exists in raising heavy beef cattle at the South. There is no reason why it should be considered a misfortune. I am perfectly sure that the South has an opportunity for animal growing exactly as good as any other section of the country, care being taken to select the proper breed.

The time has arrived for adjournment. I intended to have an essay read by Mr. Hazard, on Jersey cattle, and this will be first in order in the morning.

Mr. SAUNDERS. I move we now adjourn.

The motion was agreed to, and at 5 p. m., the convention adjourned.

FRIDAY MORNING, *January* 13, 1882.

The convention was called to order at 10.30.

The president announced the first business to be the reading of an essay by Mr. Hazard, of Pennsylvania, which was presented, as follows:

THE CHANNEL ISLANDS—THE PEOPLE AND THEIR CATTLE.

By WILLIS P. HAZARD, WEST CHESTER, PA.

Directly south of England flows the British Channel, connecting the North Sea with the North Atlantic Ocean, and separating England from France. After passing through the narrow straits between Dover and Calais, the English Channel widens very much, owing partly to bays and harbors on the English coast, and partly to two large indentations or bays on the north coast of France. In the easternmost bay lies Havre; on the point of land separating them is Cherbourg, the naval depot of France, and in the western bay lies a group of islands and rocks quite adjacent to the coast of France, and so completely land-locked and within the shelter of that country, that the map-student is amazed when he is told that these islands belong to England and not to France; still more so when he visits these islands and finds nearly every hamlet and parish bearing French names, the customs and habits French, and most of the transactions carried on, and the papers published in the French language.

From their situation, these islands are called the Channel Islands, though more popularly known by the individual names of the larger three of the group, viz., Jersey, Guernsey, and Alderney. These have attracted the attention of England and America in recent years, through the merits and beauties of their two famous breeds of cattle, the Jersey and Guernsey breeds. And these have, until within a short period, been generally known under the generic but erroneous name of Alderney cattle.

But independent of these more modern claims to notice, the islands have a story and song of their own, their history reaching so remotely into the past as to be lost in the dim obscurity. They were famous in Roman narratives of wars and conquests, were prominent in the histories of William the Conqueror, of King Charles, and of Queen Elizabeth. Their ecclesiastical history embraces the rites of the Druids; their temples trace back almost to apostolic times, and the Romanists and Protestant faith have each at times held entire sway, and been the cause of intestine as well as of outside wars and attacks. The people often called to repel, have left the evidence in their many towers, castles, and forts still standing. And to this day we find in their independent spirit, and their laws, the evidences of their freedom and their courage.

The Channel Islands are by many supposed to have at one time formed part of France; and, indeed, tradition asserts that at certain times of low tides, the passage from one shore to the other was made on foot over the rocky connection. The peculiar character of the many rocks surrounding the islands, at times jetting from the sea,

and at others hid just beneath the surface, all indicate the wearing and disintegrating power of the sea and its conflicting currents, as they wash violently in the changing channels. These are what make the passage between the main land and the islands so dangerous, especially during storms and fogs. The passenger never considers he is safe until his foot is on dry land. Though the length of time of the trip from Southampton is usually about eight hours, it is frequently two or three times as long. Where the tides rise and fall often from thirty to forty feet, and the steamers sail at one particular hour, without regard to the state of the tide, and the narrow channels between submerged sharp-pointed rocks are thus made still narrower, it is not to be wondered that shipwrecks occur. One took place in the main harbor of Jersey, on a Sunday morning in February, while we were there, and within three hundred feet of the steamer's anchorage.

The larger islands lie nearly south of each other, and of England, and in the following order: Alderney and the Casquets, about 60 miles from England; Guernsey, Herm, and Serk, 70 miles; and Jersey 90 miles. Alderney is 3½ miles long, by 1 mile broad, having 1,962 acres; Guernsey is 9 miles long, by 7 miles broad, having a population of 30,000; and Jersey is nearly double the size of Guernsey, being 11 miles long, by 5½ miles broad, having 40,000 acres, and 57,000 population. The smaller islands of Serk, Jethro, and Herm, are sparsely settled, but very picturesque and beautiful to the lover of natural scenery and history.

THE SCENERY.

All of them have rocky coasts of the wildest grandeur, difficult of access, and only equaled by those of Cornwall, parts of Ireland, and of Scotland. Forbidding as is the approach, the interiors of these islands have some of the loveliest rural scenery, reminding the tourist of the softened landscapes of Devonshire. The climate is so mild and the atmosphere is so moist that nature rounds all the outlines with a profusion of verdure nearly always fresh and green. While the majority of the roads are level, still there is enough hill and dale, intersected by streamlets, to ever present varying undulations and views in the landscape. Consequently the lovely scenery, the mildness of the climate, and the novelty of the surroundings, together with the ever-changing sea-views, attract tourists, invalids, artists, and naturalists, at all seasons of the year; though the larger number visit the islands in the summer or holiday season; at this time the daily boat frequently carries over four hundred passengers. Were it not for great danger at all times in following the narrow channels through the great masses of rock, and contending with the strong tides and conflicting currents which sweep with great force through the great bay on the French coast, in which these islands are situated, visitors would be numbered by many more thousands. The steamers are frequently obliged to lie by during fogs, and at all times to move with great caution. But when the winds are quiet and the atmosphere is clear, the voyage is one of great pleasure.

THE JOURNEY.

I wish I had power over your imagination, and then you would realize that we were taking one of the cars of the Southwestern at Waterloo station in London, in the afternoon, so that we may have time to look around Southampton, the great shipping port. As we arrive alongside the dock, our luggage is transferred to the steamer. We have secured a good berth, and we stroll up into the city to pass away the hours until midnight, when the steamer will leave. Having stopped at the hotel and eaten a good chop, washed down with a glass of ale, albeit it was spiced with a good deal of snobbery from the waiter, we feel better fortified to brave the terrors of the channel voyage.

Again on board of the steamer, we patiently watch the play of the harbor lights upon the plashing water, as they rival the sheen of a nearly full moon. Having also filled in the time by asking the officers and men of the steamer what was the prospect of a smooth sea, and being reassured by them, we gladly hear the whistle of the last train approaching; the passengers are soon transferred to the steamer; the bustle incident to the starting is at last over; every passenger is finally accommodated with a berth; the steamer is cast loose, and is soon under way. With a lingering look at the surroundings, and the harbor's lights as they dim in the distance, we trust to the bright moonlight and the favorable wind for a fair passage, and seek our berth, hoping to get to sleep while the steamer passes down the Solent, past the Isle of Wight, and before leaving the three light-house rocks, called The Needles, at the point of the Isle of Wight, and enters upon the conflicting currents of the channel. Vain hope! for the snoring of your neighbor, who can sleep anywhere, the incoming of those who have staid on deck to see the scenery by moonlight, and above all the stowing away of the cable chains by the donkey engine and steam windlass, in a

compartment built in the center of the berth cabin to hold it, all these drive away sleep, until you have passed the Needles, and meet the long swell or the chopping sea. Then for the hours of nearly mortal agony! And you lay wondering why you should have to start out on such a voyage at midnight.

The day at last breaks, and after a time you summon courage to go upon deck, and find you are passing through the Swinge, or pass between the Casquets, on the right, and Alderney, on the left. As the steamer does not stop at Alderney, you gaze at it as it rises with its blue outline against the horizon, and turn to the Casquets, to see these rocks rising abruptly above the water, and surmounted by three lights one hundred and twelve feet from the surface, directly in the track of vessels. The lights can be seen in clear weather for 20 miles; but in foggy weather a bell is sounded. These Casquets are only the terminal rocks of many others connected with Alderney, with a narrow, dangerous, rocky passage between them.

GUERNSEY.

On we go through the bay of St. Michael, finding the currents combatting with the tidal wave, for here they set from every point of the compass, owing to the vast numbers of concealed rocks, but as it is not foggy we know we have not that great danger impending over us. Guernsey, ten miles from Alderney, is shortly seen looming up; at first like an indistinct fog, then as a leaden-colored line upon the sea, gradually becoming more distinct and defined, until we descry a bold, rocky coast, rising in bluffs from the sea, but indented here and there with bright green sward leading down to the sandy beach, whitened by the glare of the sun.

Doyle's monument towers on one of the bluffs, and shortly Castle Cornet comes in sight, on a high hill overlooking the town and harbor, and we notice the signals being run up to announce our approach. The arrivals and departures of the steamers are the events of the day, and the sleepy town is soon enlivened, for here comes the connecting link with the rest of the world, and the mails and papers are eagerly looked for.

On the left lie Herm and Jethro, and further in the distance Serk; we glance at them as we pass by, and round into the stony harbor, shooting through the narrow entrance, and soon ride safely at anchor in smooth water, under the shelter and protection of Castle Cornet, itself originally constructed by the Romans, and having many historical associations.

ST. PETER'S PORT.

Let us look behind these and we shall see the stony, rusty-looking old town, rising in terraces upon the hill upon which it is built, fronted upon the shore by a wide esplanade, and backed by the green of the suburbs, prominent among them being the house of the governor and Carey Castle.

A stroll through the town of St. Peter's Port will reveal some of the quaintest old structures, hundreds of years old; the narrow, winding, hilly streets often without sidewalks, but stony roughness in the middle of the streets; these lined with curious small shops, or thronged with a bustling population, partly in quaint costume. We look into the old church, now nearly six centuries built; and as a contrast, visit the handsome new market-house and hall. Here we have a look at the rural population and products. In the middle of one part of the house are benches, placed back to back, upon which sit a number of women chatting with each other, each holding upon her lap her market basket, with its contents covered with linen or other covering. How gallant and kind it seems to have provided for the female purchasers a place for rest, and to have a social chat. But directly we are undeceived, for when we pass near several of the baskets are uncovered, and the contents are attractively displayed to tempt a purchase. How nicely the golden circles of butter look; how white and fresh the eggs! Ah, then, here the women sell the butter of their own make, and well they understand the art; that's why the circles are nearly double the size of our pound lumps, though they are only half as thick. Well stamped, and of the deep rich color which only Guernsey cows can yield, taste after taste will assure you there is none better. As the herds are not large in Guernsey, each maker can easily bring in her basket the few pounds she has to market, and the few eggs she gathers, for poultry is not plenty in Guernsey, for it is not a grain growing country, and Normandy and Brittainy, in France, supply most of the poultry and eggs used. We saw, at one time, forty tons of eggs upon the wharf in Jersey, landed from a French steamer, and *en route* for the great markets of London. They were packed in neat flat boxes, holding one hundred pounds each, and were there piled up in many a row.

Further rambles through the market revealed many curious edible things, particularly among the crustaceans. There were shrimps, muscles, snails, the haliotis or sea ear, escallops, oysters, and other to us unknown bivalve and univalve edibles, as well

as crabs and lobsters of large size, and crawfish. The variety of fish of course is very great; there are the delightful whiting and turbot, rockfish, mullet, cod, mackerel, and tunny; also the *roselet* smelt, and *lançon* sand-eel are said to be delicate little morsels. But, strange to say, many of the fish are brought from London to this market, as the fishermen seem to decline to break bulk. Fish shipped early in the morning on the steamers is eaten by the Londoners the next morning.

The meats we examined with care, and tasted with relish the Guernsey beef, as we felt anxious to test its quality, to know whether the animal of that breed made good beef. We found it to be juicy, tender, and delicious, with a fine peculiar aromatic flavor. The color of the fat is of a deep orange color, much darker than that of the short-horn or Devon, and to many would be somewhat objectional, but only from prejudice. It is even of a deeper yellow than the fat of the Jersey. The meat at the same time is of a deeper red than that of other animals. Most of the beef used in Guernsey and Jersey is imported from France, and is landed under special restrictions. The animals are driven under an inspector's eye to the public yard, marked, and only allowed to come out to be killed at once by the butcher. The islanders guard their two noted breeds very carefully from any chance of being crossed, and do not allow the cattle even of one island to be imported into the other. This is one of the values of those animals imported into this country—the assurance of the purity of the breed.

Of vegetables, the variety is not very large. In winter mainly potatoes and cabbage; of the latter, a variety is kept up by broccoli, cauliflower, and brussels-sprouts. In spring and summer, asparagus, peas, beans, beets, salads, carrots, radishes, turnips, &c. Celery is plentiful and good; tomatoes are scarce, and unappreciated. Parsnips are raised in large quantities, and are, with ruta-bagas, one of the chief reliances for winter feed for cattle. It is to the parsnip it is said the fine flavor of their beef and pork is to be attributed.

Let us keep on ascending the steep and winding streets, and now turn off to take these steps or stairs as more convenient, which bring us to the upper street more quickly. As we stop to take breath, look around each time, and what a panorama you behold! Far below you is every variety of rocky coast, indented by pretty coves, with sandy beach, upon which the sea rolls up, dashing itself into spray, which sparkles in the sunlight like so many diamonds. There lay Jethro, Herm, and Serk; and, as it is a very bright day, we see the blue outline of Alderney in the distance. Directly below us lies the town, with its several church spires, its Victoria and Albert monuments and Elizabeth College, all standing out in bold conspicuity. A moving column of smoke attracts the eye to the esplanade of the town, skirting the coast, and we see the dummy engine of the tramway drag its retinue of cars to St. Sampson's, the other port of the island. If we take the cars to St. Sampson's we shall witness the little fleet of ships loading with the Guernsey granite cubes, which are to pave the streets of London.

VICTOR HUGO'S HOUSE.

As we descend from the hill let us stop midway and inspect D'Hauteville house, the residence of Victor Hugo, for perhaps nowhere else can we see such a collection of curious old oak carvings, tapestries, rugs, chests, altar pieces, chairs, candelabra, and all that rubbish which is denominated bric-a-brac. The walls, the ceilings, the floors, the beds, everywhere it can be stowed, are covered and hidden under this mass of carved wood and tapestries. Throw open the window-shutters as you may, you cannot illumine the somber effect produced by these quaint old bits of carving, these faded old tapestries. If ever there was a home for ghosts it is here, and momently one expects to see the hangings move, to see some helmeted creature lead forth some stately dame, clothed in quaint haberdashery. Ah, what a night of horrors might be conjured up there after a heavy supper. There stands the bed as prepared for Garibaldi, with its moth eaten covering, its faded hangings; but he never had the courage to try to sleep a night in it. This wealth of antique furniture properly bestowed in a number of houses, would be charming; but crowded into this one house overdoes the matter. Victor Hugo was an enthusiastic collector, and gathered this material from every quarter in the island, and the tapestries from abroad. Now it has become so very scarce we, with difficulty, could pick up a few bits of carving and majolica. The article we should most prize was the camp chest of Napoleon, studded with brass nails, so constructed as to form a chair, a table, and to hold his maps, dishes, &c. Victor Hugo's "Toilers of the Sea" should be read by every one interested to know more of Guernsey life. In Hauteville house Hugo spent many years of his exile, and his figure became well known in the town; now he visits it only in the summer. From his balcony is presented one of the most ravishing views of the sea and of the rocks.

THE RURAL PORTION.

Let us spend our second day in a visit to the rural portions of the island. As we drive up the steep hill to leave the town we pass through the newer portions, mostly of houses built in the English style and by the English, who are yearly supplanting the old Norman French inhabitants and their descendants. The houses are of dressed stone in the English villa style, with ornamented front gardens, and grounds around them; neat with paint and plate glass, and each with the name of the villa painted upon it. Here you will see the wealth of horticulture which adorns the Channel Islands. We saw camelia trees over twelve inches in diameter and thirty feet from one edge of the shadow to the other, covered with many thousand buds and flowers, of the purest white or delicate shades of pink and crimson. They are almost constantly in bloom. Fuchsias here grow as high as the cornice of the house, like trees. Geraniums are standard, and bloom all winter. The arbutus ripens its winter strawberry. The magnolia is a noble tree. The noted Guernsey lily, though originally from Japan, flowers freely everywhere, as well as all the Cape bulbs. The gladiolus, ixia, and belladonna are to be seen in profuse blooming. We saw almost every species of tropical plants growing in the nursery grounds in the open air, and rhododendrons in the richest bloom and variety of color.

As we drive along the excellent roads and past the adorned grounds of the houses, we cannot fail to be gratified with the exquisite floral display and the abundant perfume. The roads are bordered on each side either by hedges of holly or by banks of earth upon which grow the gorse or furze, the butcher's broom, the bramble, and other wild plants, and the whole is softened by the ivy clinging, twining, and covering everything with its dark rich green foliage. While overhead we have shelter from the ilex or evergreen oak which is the most common tree, and always retaining its bright green foliage, varied by the elm and the beech. Trees are not much fancied by the farmers as they harbor birds, but they are allowed to grow in the hedge banks along the roads for the fuel they furnish, and consequently they are kept so trimmed as to spoil their beauty. Few things are more unsightly than these tall tree trunks in winter, with diminutive switches or branches growing from every side of them. These are constantly pollared and made into faggots for the open fire places or ovens which are found in all country houses. They use also for fuel the gorse dried, some of the seaweeds, and most curious of all dried ordure of the cow. Great piles of all these can be seen stored away under the farm sheds.

In summer these shady roads and lanes winding through the country are frequently very beautiful, the branches meeting in graceful arch overhead, and presenting a continuous perspective, realizing the Gothic arch which is said to have had its origin from this natural arch.

The roads are built on the Telford plan, and are of the most admirable kind. First is laid a bed of large stones, upon which are placed medium sizes, and upon that small stones are broken up. They are kept always in perfect repair, and at stated times raked and swept. Along both sides of leading roads are side paths about four to six feet wide, raised six inches from the roadway, and separated from it by a line of stones set edgewise. The wheels of all vehicles are made much heavier than ours, and with tires of much broader tread; in fact, such vehicles as our trotting wagons or carriages would not be allowed, as they would soon cut the road into ruts, which are never seen on these islands. Yet, strange there is much less driving than with us, and much less pleasure driving, partly owing to the economical habits of the people, partly to the good sidewalks and the bracing nature of the atmosphere inviting to walk, and partly to the little value placed upon time.

GUERNSEY AND JERSEY FARMS.

The farm-houses, formerly small stone cottages, one story and a half high, are now of much better character. In Guernsey, many more of the old houses remain, but in Jersey these are either being torn down and the material used again in new and more commodious structures, or they are converted into stables. In Jersey, in a few years, it will be difficult to find true specimens of the old thatched stone cottage, so fast are the inhabitants getting rich from the London market prices for early potatoes, fruits, and vegetables, and from the sale of live stock at high prices. In Guernsey, the people, too, are more conservative, and pursue the old methods of their ancestors more closely than in Jersey. The cottage may be more picturesque, but the mansion is more comfortable, and it was partly for this we admired the Guernsey landscape more than that of Jersey; it had more of the quiet softened beauty of luxuriant nature, while that of Jersey had an air of new smartness which did not soften the landscape; only in Jersey we found more of the beautiful shady lanes.

Surrounding the farm-houses are the stables, wagon houses, piggeries, &c., mostly

in great numbers, of one story or one and a half stories high. Barns are not seen or needed; the hay and grain are stacked out, and frequently great heaps of roots are dumped on the ground and covered with some straw or earth, and fed from one end of the heap as wanted. All these buildings and surroundings are kept in bad order, and the cattle are shut in dark, foul, reeking stables, with little light and no ventilation, as much for the sake of warmth as from carelessness. Were it not that the cattle are let out every day for a short bite at the grass in winter time sickness would be very prevalent among them. In Jersey the stables are now generally much better, and, in many cases, two stories high, though they are kept but little cleaner. In each island stone walls are plenty about the farm-yards and entrances, and are really necessary for protection against the severe and cutting winds which at times prevail in winter and spring. The past winter was the most severe for forty years, and I saw snow from four to six inches deep, which laid for more than a week. It was comical to see some of the sleighs improvised for the occasion by some of "the bloods," and the contrast of the fine horses and harness to the rough sleigh. I saw hedges, trees, and plants all blackened by the cutting wind as much so as if scorched by fire, and their development greatly retarded.

THE JERSEY CATTLE.

The cattle of these islands are now famous for their beauty and their merit, and are of late being widely scattered over our whole country. In the comparatively short time that they have assumed prominence there must be some great value in the breed to so assert itself. We shall, therefore, make it our object to trace the history of these breeds, and to point out why they are so sought.

The origin of the Jersey breed has been by most writers traced back to the neighboring coast of France, and more particularly to that part of it called Brittany. To this day cattle very similar in size and appearance, and which might be sold as inferior Jerseys, and have been largely so sold in England, are to be seen there. Professor Gamgee wrote a special treatise on Brittany cattle, advocating their merits. But the Brittany cows are not so well developed in their udders, have not as deep barrels, or, as we say, have more daylight under them, nor are their horns as fine or crumpled as the Jerseys. But this inferiority is much owing to the ignorant management by the Brittany peasants and their careless breeding.

The curious fact, too, in support of this origin, is that wherever Druidical remains have been found there also has been prevalent a small breed of good cattle, and mostly of black and white, or of a cream or dun color. The original colors of the Jersey breed, as stated by writers of the time, were of black and mulberry, and of a cream color, and in most of them plashed with white. To this day a black Jersey, with the peculiar mulberry brown stripe running along the chine and spreading into the black on the sides, particularly if it has the golden lustrous tinge which fine hair and oleaginous skin give it, is one of the best colors, if there is anything in color, as we year by year grow to think there is, that you can have on a Jersey.

Whatever the origin of this breed, we know the fact that for two centuries it has been famous in the island as a good one, and that great care has been taken to perfect it and to keep the breed pure. Necessarily in so small an island, and where the number of animals were so few, the effect of breeding without introducing new blood would be, to a certain extent, in-and-in breeding, consequently certain traits would be perfected, increased and maintained; while at the same time, owing to the manner in which this was carried out, the size and stamina of the animals might be lessened.

That this is the case, those who have paid attention to the breed for a length of time are perfectly well aware. Such remember the size and color of what is now called the old-fashioned Jerseys. They were of a much larger size than at present, and would weigh from ten to twelve hundred pounds, and were usually of a dun color. Then came the fashion of having them smaller and finer, and of a cream color, and mostly blotched with white. The next color sought for was for a deer or fawn color, and all the better if it was shaded in the flanks and about the head with black. As some would retrovert and go back to the old colors, and come solid without any white, and of course were fewer than the others, they were sought for their rarity, and solid colors became fashionable. In breeding for these colors, some would come solid colors, tipped with black, and thus the next fashion was to have solid colors with "black points;" and black tongues and black switches became the fashion. The next color sought for was the squirrel greys, and now to-day it is the blue and silver greys. And so it will continue to be as long as there are charlatans in the trade, who generally are the loudest voiced, and talk up those wares that they have to sell, and as long as buyers will control their good sense and pay the prices asked by fancy breeders. To-day a returning sense to reason is being shown, and it is demanded that performance at the pail shall be the true test. This *is* the true one, only the breeders, not to be outdone, cry out "blood will tell," and demand their fabulous prices for the "forty-eleventh" cousin of an animal that has made its sixteen pounds of butter.

More than a hundred years ago the states of Jersey, in 1763, and again in 1789, passed stringent laws to prevent the importation from France; and more recently they passed a law to prevent importation from Guernsey, England, or elsewhere, thus using every effort to maintain the purity of the breed. The Royal Jersey Agricultural and Horticultural Society was formed in 1833, and they have jealously helped to maintain this purity, and have been mainly instrumental in leading to its development and improvement. They adopted a scale of points in 1834, which has since been altered, which gave breeders an intelligent guide toward creating perfection. In 1838 it was first required the pedigree on both sides should be stated, and this led to the formation of the Herd-Book.

In 1844, "the Channel Islands or Crumple-Horned cattle" first received prizes in England from the Royal Agricultural Society of England, and the prize-takers were sold for about thirty pounds each. From this time forward the breed came rapidly in favor in England until now it is the fashionable breed with the nobility and gentry, more than two thousand being imported into that country each year, while up to this year only one-tenth of that number are imported here.

In 1853 the effect of American wealth and influence began to be felt, for then there were several animals sent to this country, which was much increased in the following two years; prize-takers being mainly bought for the United States. The earliest recorded importation was of one cow in 1815. The number of persons interested in Jerseys had so increased by 1869 that the American Jersey Cattle Club was then started, and the first volume of the Herd Register was published in 1871, with a record of five hundred and thirty-nine bulls and one thousand four hundred and twenty-seven cows registered, and it has now increased to nine volumes.

The two leading sources of income and profit with the Jersey farmer are his cattle and his potatoes. For the development of these, his farming is mainly directed; and from the small sizes of the farms, his farming is more of the nature of gardening. Pasture, hay, and the cultivation of roots and potatoes, occupy the bulk of his attention.

The grass is strong and rich, much like our green grass or blue grass, and clover and lucerne is much used. The cows are led out in summer in the morning, and tethered with a rope or chain to an iron peg driven into the ground by a wooden mallet, and are allowed a space of about thirty feet in diameter. They are changed again at noon. In summer they are milked three times a day—such cows as are flush in milk—from April to August, and during the other months twice a day. When milked three times, the butter is not greater in proportion. As this work is always done by women who lead them to pasture and to water, the animals become very docile.

It is thought an extraordinarily good cow that gives twenty quarts—the quantity being more usually from ten to fourteen quarts—the medium quantity is possibly ten quarts. In summer it requires nine quarts for one pound of butter, and in winter rather less, if they are fed upon parsnips.

The milking is done by the women into a pôt, over which a linen cloth is spread, and upon which is placed an escallop shell. The milking is done upon this shell so as not to be forced through the strainer, and to prevent the rapid wearing of the cloth. From the shell it overflows, and thus is strained as it passes through the cloth. The milk is placed in Norman coarse unglazed earthenware "crocs," or tin pôts, and stands about ten inches deep, until all the cream is risen, which is hastened, in winter, by placing it upon the warm hearth at bed-time. When the milk is coagulated, the cream is loosened around the sides by the finger, the crock is dexterously tilted, and the cream slipped off. If any is left, it is skimmed with an escallop shell. In Guernsey they frequently churn the whole milk after standing for days. Some crocs have a hole with a peg in at the bottom, by which the serous milk is drawn off. They endeavor to churn twice a week in summer. Clover and lucerne are considered to whiten the butter in summer, and potatoes and turnips in winter. The natural pasture, or parsnips, make the richest butter. Late in the fall and in winter the cattle are turned out for a few hours each sunny day, for here the grass is always green, though not possessing strength in winter. The grass in February was as it would be with us about the 10th of May.

The pasture is considered sufficient in summer, and in winter the main feed is hay and straw, parsnips, ruta-bagas, and potatoes. The milk is sold in the towns at three pence, or six cents, per quart, and sometimes in winter at seven cents. Butter is good, but generally not of first-rate flavor, and sells in winter for about two shillings, or fifty cents, and not much less in summer, for the demand is much greater. Not near enough is made for the consumption, and large quantities are imported from France. It is usually self-colored, not much coloring matter being used, though one will frequently hear the term "a white-butter cow."

The butter is churned in a peculiar shaped old dash churn, though the barrel churn, with fixed dashers, is being much introduced. As no farmer makes much butter, it is all done by hand. It is made into round stamped pats, about twice the size of ours, of 18 ounces to the pound, and is sold in the market in St. Helier's, by the women,

from their baskets. We saw no spring-houses, and the milk is usually kept in an apartment partitioned off from an outer sort of kitchen or store-house, where, in the main part, frequently roots were stored, and not with that care necessary to make the sweetest tasted butter. Cheese is now seldom or never made.

SIZE OF FARMS, AND PLOWING.

Each cow is calculated to use two and a half to three vergées of pasture, according to quality. The vergée, which is their usual computation of ground, consists of forty perches of twenty-two square feet each, and about two and one-fourth vergées equal one acre. One hundred and four pounds of Jersey are equal to 112 pounds avoirdupois. One hundred and ten gallons Jersey equal one hundred gallons English.

The farms contain, perhaps, on an average, twenty to twenty-five vergées; a good size farm containing fifty to seventy-five vergées. Land is broken up by a large heavy plow, the beam resting upon two wheels, which is drawn by four, six, or eight horses. In February occurs La Grande Fouerie, or great digging day, when the neighbors assemble to assist in breaking up the ground, for much spading is required to accomplish the depth of 12 or 14 inches. First precedes the two-horse plow, which opens a double furrow, which is widened and deepened with spades to a trench 2 feet wide and of the right depth. Then the small plow starts again, throwing the next furrow into this trench, and it is followed by the large trenching plow deepening the furrow, the first few feet having been deepened by spading, to allow the trench plow to take fair hold. The plows are followed by one or two spaders, who break heavy clods or fill up hollows. As each furrow is plowed it is completed and squared by hand. This subsoiling and trenching makes a fine mellow soil for parsnips and potatoes. A good dinner or supper washed down with cider, or something stronger, makes "digging day" a jolly as well as laborious one.

When the ground is prepared, as early in March as possible, or in warm sheltered spots even before that time, every farmer is busy setting out his potatoes, which he has been sprouting with much care in his kitchen or stables. In the stable small, square shallow trays are placed upon racks above the cattle's heads, so that the warmth arising from below will affect the potatoes. The tubers stand on end, placed close together in the tray. The kidney potatoes are those most used. It is of the greatest importance to have potatoes ready for market at the earliest moment; for the price is affected very rapidly in the London market. Potatoes which bring six pence per pound the first week may not bring three pence the next. In the height of the potato season, many extra steamers are put on specially to carry this freight, and great competition exists among the commission men in the large cities and towns in England for the consignments. Many thousands of bushels are rushed into market in May. From these islands the earliest go to London, though Spain is now entering largely in the business.

Green stuff is next marketed, consisting of radishes, early onions, asparagus, salads, early cabbage, broccoli, and cauliflower, &c., &c.

FRUIT.

Fruit claims much attention; about twenty tons of grapes are shipped yearly to London. These are grown under glass, and the long ranges of glass-houses are a striking feature. In these also are grown some of the finest peaches, early strawberries, green figs—which will also grow in the open air on trees trained upon arbors—and dwarf pears. The Chaumontelle pear grows to a very large size, and is very rich and juicy, and a good keeper; they have them all through the winter, and we have eaten them in May. Apples are largely grown, and one hundred and sixty thousand bushels are exported, in good years. They are not good eating apples to an American, used to much finer flavored kinds. Vast quantities of cider are made from them; it is the popular rustic drink, and formerly it was an important item of export, but now the orchards are becoming neglected.

One of the vegetable curiosities is the cow-cabbage, which is a leafy stalk, growing often 8 or 10 feet high, and of which walking-sticks are made; the leaves are fed, and also used for marketing butter.

FERTILIZERS.

The farmers enrich their lands with, in addition to the barn-yard manure, several kinds of commercial manures; but their principal reliance is upon *vraic* or seaweed, gathered from the coast and from the adjacent islands and rocks. There are two vraic harvests, one in February and March, lasting five weeks, and again from June till Au-

gust, lasting about ten weeks. The dates are announced by the legal officer, when every one may commence to cut, so as to give all an equal chance, and at the proper time not to eradicate the weeds. These are of two kinds: the Fucus, or bladder-wrack, containing much organic matter, and therefore more valuable, and the Laminaria, giving the most valuable ash. The former, when drawn from the sea and deposited in heaps or spread upon the fields, will partially melt away, and is absorbed by the ground. The seaweed is sometimes used, when dried, for fuel.

LABOR.

Labor, formerly very cheap and plenty, is every year growing scarcer. Toward the close of winter laborers come over in the French steamers from Normandy and Brittany, both male and female, dressed in their peculiar costumes. The latter wear no bonnets, but a linen sort of cap, a triangular handkerchief around the neck, short, linsey-woolsey skirts, coarse stockings, and sabots. They are not attractive in appearance, but very sturdy, and walk with a strong stride. They take care of the cows, do the house-chores, and work in the fields, planting and marketing potatoes, &c. Hands will be hired for the season, and both sexes sleep in the barn, and Sunday is spent in baking for the week, washing, &c. They provide their own food, which consists mainly of bread and cider. Thus, though they get little, they spend little, and return to their homes with the proceeds to spend the winter. The wages are 15 pence a day, when employed by the month, and on Sundays they do odd necessary chores for their board. If employed by the year, they get 15 pence the year round, per day. A man can terminate his engagement by giving four weeks' notice, and the employer can do the same, which they often do in the potato-picking season, as they can get 25 shillings per vergée. Most of the employés on the farms are French, and they work very hard.

SALES OF CATTLE.

From the small size of the farms, it may easily be supposed there are no large herds in Jersey or Guernsey. Ten or twelve is an unusual number: five or six are more frequent, and most every farmer tries to have one or two heifers to sell. Altogether, there are nearly twelve thousand head in Jersey, and between five and six thousand in Guernsey. The sales from the two islands are less than three thousand each year, the great bulk of them going to England. Canada is beginning to take a few, some go to France, and about three hundred come to the United States.

America is taking the best, and paying the highest prices, and with the care taken in breeding in this country, we shall soon, and we might almost say now, have finer animals than the islands can show. They would hardly believe my statements of the yields of some of our cattle. The breeding is not at all worthy of copying, and we have no lessons to learn from them. With some exceptions, the stables are filthy and bad, the cattle are dirty, and not properly cared for. Then, the bulls are used when only twelve months old, and sold off when two years old. I asked the reason of thus sacrificing an animal in his prime, and just when he was in the height of his fame, and had proved of value. Their reasons are, that they get fierce, they get heavy, and as there is a law requiring bull beef to be so marked when sold, and it brings a lower price, that it does not pay to keep him longer than two years. Surely this course pursued steadily of using an immature animal must degenerate the race. Heifers, it is desired to bring in at two years of age, and in the spring and summer, as they sell better for shipping. So that they are constantly selling their animals before they have an opportunity of testing them, and many of the best have left the islands under these circumstances. The prominent, careful breeders seeing this are endeavoring to check it, but the demand is greater now than the supply. Prices are rising, and the farmer is tempted by the prices to part with them. We can supply better stock to-day in this country than can be imported. As only registered or pedigree stock can now be entered in the American Register, this new rule has cut off from coming many of the best stock in Jersey. Consequently the number being limited, the prices have much increased for the eligible ones.

GUERNSEY CATTLE.

What we have said of Jersey may, with equal justice, be applied to Guernsey About the same attention is paid to breeding their stock, but the farmers are more contracted in their views, and generally, if they can use a bull for a shilling they will not pay 5 shillings for a much better one. The result of this is seen in the escutcheons, and the hair of their animals. The one is not as well developed as might be, and the other is not as fine. But the Guernsey cow, we think, is rising rapidly in the estimation of our farmers. She is an animal of larger size, of greater yield, of greater

docility, and yields the richest quality of milk. Her butter is self-covered, even in winter, is firm and of beautiful texture, and her golden milk will color that of from six to ten common cows.

THE LANGUAGE.

The language of the people is mixed: many speak French or a Norman-French patois, and many speak both French and English. The language of the courts is French. It is in a measure unwritten French, or French of the past that is spoken by the peasantry; modern French they could hardly understand. But as the communication and business relations are mainly with England, the French will gradually pass away with the incoming of the rising generations.

THE MONEY.

The money in use in Guernsey is of their own currency, and French money, though the hotels and some other payments are required to be in British money. There is a difference between Guernsey and English money of about five per cent., which the buyer with British gold saves. In Jersey it is all on the English money basis, though French money is taken at the discount.

Isolated as are these Channel Islands, each one is a little world within itself, and the American who visits them for the first time seems to be transported backward many years, and is brought near to old time ways. It has that charm as well as a certain novelty, and he enjoys the repose of life as in such strong contrast to that of the modern Babel, London, so recently left. If he has a taste for agriculture and fine stock, he will have a daily treat, and we shall never forget our rides every day, when we would start out at nine o'clock, and not return till six or seven, forced to take repeated lunches with the hospitable farmers we visited. The charming scenery on the coast or inland, the genial climate, the profusion of floral wealth, all were constant pleasure. Every taste may be suited, and find genial employment for every spare hour.

At the conclusion of Mr. Hazard's essay, Professor Roberts read an essay, as follows:

THE SCIENCE OF DEVELOPING AND PERPETUATING MILK QUALITIES

By Professor Roberts.

In the United States for the last two hundred years the almost invariable practice with all farmers producing little or much milk has been to select and rear more or less of the calves from the best milking dams. In this way it was supposed that the good milking qualities of the herd could be perpetuated, and many were so sanguine as to look for improvement. Sometimes it occurred that the offspring proved to be as good, or even better, than their dams; but in a large majority of cases they were inferior. This practice of selecting offspring of the best dams, with little or no thought or pains as to their qualities—either apparent or inherited from the sire—has been in practice for a long time, and yet our common cattle are neither a breed, a sub-breed, nor good grades, but are much inferior, as a whole, to the European breeds from which they sprang.

Success in developing and perpetuating a milking breed is certainly not by simple selection on the dam's side only—though it is, I admit, a small factor of the sum total—but those who use this method alone will constantly meet with failure, and be doomed to labor for the merest pittance, and in the end be distanced in the race. In this age of rapid progress and sharp competition, if the farmer is to have his just share of the profits, he must think quickly and intelligently, get at the roots of things, study cause and effect, and join science with practice. We have met with failure. Don't let us be too proud to own it. The cattle on a large majority of our farms are living witnesses against our methods, or lack of methods. We have cheap lands, nutritious grasses, abundant grain, a pure climate, plenty of cheap building material, and intelligent free labor; yet failure is written almost anywhere you choose to look for it. See it in the concentric circles of the horns of the superannuated cow. See it in the bull-headed, thick-necked heifer. See it in the gothic-ribbed, pot-bellied, narrow-chested cat-hammed calf. See it in the weak-constitutioned yearling, as it shivers at the watering-trough. See it in the contracted udder and attenuated stream of milk that is ever pounding on the bottom of the milk-pail. And, lastly, see it in the ledger:

Dr. to labor and food	$60
Cr. by milk and carcass	50
Amount to balance	Failure

I do not mean to say that each individual animal of our common stock is a failure, but I do know that a majority of them fail to pay for their care and food, and give a fair profit.

The farmers of the northern portion of the Kingdom of the Netherlands wanted just such an animal as many of our own farmers want to-day; a sizable, fair, beef animal, with uniformly good milking qualities. They accomplished their object right well, long years since; while we, with equally as good material for the last fifty years, and far better surroundings in many respects, have frittered away our time and energies. Meanwhile we have imported, at great expense and risk, large numbers of valuable animals; yet, in most cases, the common cow shows no improvement, save what would occur from improved surroundings. In our earlier history men were excusable for neglecting to improve their cattle; but for the last fifty years, most of the cis-Mississippi States have been prepared to care for and maintain improved animals, and there is now no excuse for longer pursuing the haphazard, unprofitable method of the past. One of the prominent causes of failure to develop and maintain improved animals has been the ignoring of the first and great law of breeding. Without vigor, health, and vitality, the power to transmit properties is seriously weakened. If the vitality of the dam, while bearing and sustaining her young, is largely drawn upon by labor, as is frequently the case with the mare, or by an excessive flow of milk, as in the best cows, their prepotency is injured, and valuable acquired qualities fail to descend to the offspring in full force through the impoverished blood of the dam. Therefore the vitality and qualities, both inherited and acquired, of the sire, become of paramount importance. So long as a little present trouble and expense is saved, this vital law appears to be lost sight of or ignored, judging from the too frequent practice of using a half-blood, a quarter-blood, or no blood at all; falsely reasoning that if the dam is superior the offspring of necessity must be, though begotten by a sire modeled after a hat-rack.

Another prominent cause of failure has been a lack of nourishing and succulent food at critical periods. The cows are usually bred in July and August; there is then most certain to be upon us a drought, with scanty, dry pastures. Just at the critical period, when the dam has to build up the embryo and make provisions for its future development and sustenance, the food of the dam diminishes, water is deficient, or a long way off, the flies annoy, the scorching sun arrests grazing, and the result of all this is soon seen in the diminution of the milk, falling sometimes one-half in a single month. Again, later in the fall, between grass and hay, when the enervated cow feels most keenly the cold rains and sharp winds, and the system needs additional nourishment and heat, her food is frequently the most innutritious and scanty. A scanty supply of "washy" frost-bitten grass, and on rare occasions the straw-stack to run to, is considered ample, for "she'll dry up anyhow; what's the use?"

Parenthetically, let me say, the number who do not thus inhumanly treat their cattle is increasing, and may it be yearly augmented.

The acquired tendency to produce milk at this season of the year struggles for a few weeks with the normal tendency to store up fat for the winter, but finally yields to the stronger tendency in animal nature, self-preservation, and for the next four months the cow is unproductive. With such treatment, the simple selecting and rearing of the most promising calves, even though their sires have superexcellent qualities, will never result in developing and perpetuating fine milking qualities.

Shelter and care are also prominent factors in breeding and in improving desirable qualities. Because it is warm to-day little or no provision is made for the morrow, but to-morrow brings a chilly rain-storm with a temperature little, if any, above freezing, or snow squalls, accompanied by a brisk northwester that pierces to the very marrow. The attenuated, half-nourished cow shakes her head and arches her back, that as little surface as possible may be exposed, and shivers and suffers in the pitiless storm; while the farmer, in his great-coat, contemplates the scene with no thoughts that there is anything amiss, improvident, or cruel in all this. His mind is just now hard at work in the mental process of getting at the sum total of oats, corn, and hay; that by his false economy he will be enabled to sell. As he slaps his hands to warm them he exclaims, "Good! good!" and forgets the poverty of his cattle and his farm as well as the words of Solomon.

Development and perpetuation of good milking qualities are not found on the north side of a rail fence in November. Neither are they produced, though we breed in-and-in with the greatest nicety, and infuse all of the combined improved blood of the Kingdoms of Great Britain and the Netherlands, and select with the most discriminating judgment the best heifers, if suitable and abundant food, care, and shelter are lacking.

Our common cattle are the result of selection of the best, at least on the female side, for a hundred years. For fifty we have, to a great extent, infused into their veins the best blood of Europe; in fact, they are at the present time simply cross-bred animals, and in their veins courses no blood but that of an ancestry far superior to themselves. Many of them are inbred, the grandson and the son standing at the head of

the herd sired by their sire; and yet the average common cow is a failure, an humiliating failure. Upward of ten millions of them are in the dairy, and the forthcoming census report puts down the yield at 125 pounds of butter per cow, which is, without doubt, too high. Allowing 20 cents per pound to be the average price received by the farmer, and adding one dollar, the price at which the calf is usually sold, the total gross receipts per cow are $26. The cow herself in the fall is worth scarcely as much more.

Humiliating failure! Financial failure! These cattle should be renamed; they are not natives. I have called them common cows, but they are very uncommon. Since they are worth so little themselves, let's give them a big name. How would "Anti-financial, Anti-monopoly" do? But hold! I am not so sure of the last part of the name. For every one of these cows there is invested $100 in land and $20 more in buildings, tools, and apparatus. The ten million cows are estimated to be worth $300,000,000; the land necessary to support them is worth $1,000,000,000; the factories, extra buildings, tools, &c., cost $200,000,000; or the total investment for dairy purposes is placed at $1,500,000,000. The name "Anti-monopoly" will never do. The average yield of the State of New York is said to be larger than that of the entire country; but no one places it at more than 150 pounds of butter per cow per year, while most estimates give it at not more than 135 to 140 pounds. Taking the highest estimate, and allowing 25 cents as the average price of butter at the farm, adding $1 for the calf, makes the total gross yearly average receipts per cow $38.50. If we divide them into three classes, according to merit, we should probably find the first class of 500,000 cows producing 200 pounds per cow, or $50, and the second class of 500,000 producing 150 pounds, or $37.50, and the third class of 500,000 producing 100 pounds, or $25. There are, without doubt, in the State of New York at the present time 1,000,000 cows, the average income from which does not exceed $32 per cow, calf included, or each individual cow brings in less than 10 cents per day. Certainly the average common cow of New York, though making a better showing than the cows of the entire country, is far from being the animal we should and can have. When we compute the entire dairy products of our country the sum total is very large, and we like to brag a little over it. Five hundred millions of dollars is a good round sum; but in order to reach it all the phenomenal cows, all the gilt-edged butter, and all the milk sold at high prices, and all consumed on the farm, must be counted in, as well as all the pigs and calves partly raised on the by-products, and yet the entire product of each is less than 14 cents per day. When we bring the equitable portion of this enormous sum due to each animal, and place it in the farmer's pocket, it takes all the spread-eagle out of it.

After having said so much in regard to the failure in breeding the common cow, I would call attention to the thoroughbreds or pedigree cattle. A portion of them are utterly worthless; even worse than that, they are a positive damage to the country. They are degenerate, effeminate, sickly sons of a noble ancestry; living witnesses of the results of ignorance, starvation, and suffering. They are far less valuable than grades, for they introduce the worst of all evils—weak constitution. They are usually sold to dairymen at low figures, as they are considered good enough to beget grades. Their lack of vigor, symmetry, and potency is supposed to be made up by the length of their pedigree; but, write it never so long, trace their lineage back to the time of the Cæsars, embody in them all the names of the great warriors and statesmen of ancient times, they are still, to use an expressive term, "scrubs." Success lies not through the culls of badly-selected and poorly-kept herds of thoroughbreds.

There are many thousand thoroughbreds of the various breeds in our country, yet the total number of males would be but a small fraction of the number required were no others used. This being the case, the first question to be decided by those wishing to improve their cattle, by the economical method of introducing improved qualities through the blood of the sire, is the individual animal or sire under consideration superior to the herd? Even though the animal be young, want of vitality or faulty conformation may be readily detected. Second. Were the parents superior; then the grandparents? The farther back we reach, finding no faulty ancestry, the more valuable the individual animal becomes.

But pedigrees are usually so recorded that nothing is really known of the qualities or performance, good or bad, except in a few cases, and the purchaser is left to form his judgment without the necessary knowledge to do so intelligently. In rare cases, the sire and dam of the animal under consideration may be at hand for inspection, but seldom are there at hand any recorded facts as to growth or performance. A single illustrious ancestor, many generations back, is not sufficient; for who may know how many of the causes of degeneracy have since done their work?

We will suppose the sire to have been judiciously selected and marked seven, ten being the maximum. He is bred to cows inferior to himself, marked five. The offspring—supposing for the present that the potency of the parents is equal—is marked six, a gain of 16⅔ per cent. The practice of the idea embodied in this supposed case is and has been carried out by thousands of dairymen, and yet little or no improvement resulted, because what was gained by the introduction of better blood was lost for

want of proper and sufficient food, shelter, and care. The addition of qualities represented by one is lost, and they may now be represented by five, the original number of the inferior parent. Of all the causes of failure, this is, perhaps, the most prominent, and here is the mistake that is most frequently made.

Suppose that instead of neglect, better care, food, and shelter had been given, and thus valuable qualities represented by one had been added, the standard would then be seven, and the quality of the offspring would not then be half way between the parents, but equal to the superior sire. The owner's knowledge has now increased with the improvement of his cattle, and he purchases a male superior to his last, which we will mark eight; and, supposing the potency as before, the female standing at seven, the offspring would be marked seven and one-half. There are now qualities represented by only half of a unit to be added by improved surroundings, in order that the offspring shall be equal to the superior sire.

The average animal is as exact an index of the causes and elements that have entered into his being as the thermometer is of temperature. The effects can never be greater than the causes which produce them. Causes sometimes beyond our knowledge and control produce variation in animals of like parentage and give an opportunity, by selection, of eliminating, to some extent, undesirable tendencies. Taking advantage of this fact, improvement can be accelerated by selection, though it would go on, but more slowly, if no selection were made, provided improved blood and conditions were augumented. Selection is but one factor in improvement, and, as we have learned to our cost, but a very small one, unless others are joined to it.

The age and physical condition of the parents has so much to do with the offspring that they almost defy selection and pedigrees. If two immature yearlings are coupled, the result must be inferiority in the offspring, and the results are scarcely better when the parents are superannuated. The female should produce offspring at an early age, even thrice a mother before she is matured, in order that her pliable nature may be molded and her milking qualities augmented and fastened by artificial means. After she is mature, and all possible means compatible with health and vigor have been used to increase her milking tendencies, she is in a condition to perpetuate her valuable qualities through her offspring with very great certainty, provided the conditions are slightly changed. Instead of now aiming to get the greatest possible flow of milk, the primary aim should be to protect the welfare of the offspring. Her food should be not too succulent but abundant and nutritious; the period of milking should be shortened to eight months, and after having produced three or four calves under these conditions, she should be fattened and sent to the block before she reaches her ninth year; her carcass paying over one-third the value of all the food she has ever consumed. If the cow was a superior one, the common practice at present is to first get all the milk that is possible, to keep her as long as she will breed, raising all of her female offspring, and then the wonder is why the dairy is not improved. The fact is forgotten that immature or superannuated animals cannot transmit their acquired qualities in full vigor and force. I wish I could make this more emphatic, for just here lies a large element of our past failures.

What is true of the dam as to maturity, vigor, and health, is equally true of the sire, and through him, as between the two parents, the greater element of improvement is found. For if rightly used, his vigor and vitality are not endangered, but are preserved in full force long after the dam's. But if his vigor is sapped when a mere calf, and his life is spent in the foul and filthy odors of solitary confinement, without exercise or the vivifying sunlight, the element of improvement will ever stand at zero. By the methods now too common we may continue to purchase thoroughbred sires and be always improving, yet never improved.

We could learn valuable lessons from the breeders of thoroughbred horses, if we would. The stallion is fed, clothed, exercised, and molded with all the skill and care of experts. The dams are left to feed on nutritious grasses, and to run the fields at will. The result is, that the desired qualities are so fixed and improved that it is no uncommon thing for farmers to pay more for the services of the stallion than the value of the mare to which he is bred. The result shows that their confidence is not misplaced, for if the dam, though of mixed blood, be passably good and placed under favorable conditions, the offspring is certain to be, at least, a superior roadster. But if the dam is overworked, insufficiently fed, and abused, the result is just what we see in the mixed-blood farm-horse.

The professional horse-breeder has learned his business while the ordinary farmer is ever repeating the same expensive mistakes in breeding horses that the dairymen are in breeding milch cows.

Having at some length discussed the elements that enter into success and failure, we will gather together the factors of success and place them in a more concentrated form. Select the best animals attainable, consistent with the surroundings, means, and knowledge possessed. Test their qualities by actual performance, and use the information gained to make a second and more careful selection. Decide to raise milch cows, and not to purchase them. Rear only those calves that are from mature, vigor-

ous, healthy parents, properly nourished, comfortably housed, and kindly treated, that the potency and qualities of the parents may descend to the offspring. Augment valuable qualities by careful milking at regular periods and by using all the factors at hand necessary to mold the young animal to the required uses, and cause it to increase in value from the day of its birth to the days of its death. Improvement of the milk qualities of our common cattle is certain and rapid, if all the means I have pointed out are used simultaneously. There is certainly no secret or hard problem in the science of development: the only question is, how to set in motion superior causes, that we may attain superior results.

So far I have said nothing in regard to in-breeding as a means of development, because so long as the purchased sires are equal or superior to those of our own breeding and of like characteristics, and can be procured at reasonable prices, I can see nothing gained by the practice: for I cannot comprehend the mathematics that divides the sum of two and two by two and calls the answer two and a fraction. To illustrate, let us suppose that we have a male and female of identical parentage, or own brother and sister, and that their blood is 127 parts pure, or improved blood, and one part inferior. The offspring of these two animals will have the one part of inferior blood in 128, and the operation may be repeated *ad infinitum* and the one part of inferior blood remains and can never be eliminated by in-breeding. It is and must remain one factor of the 128 that produce the results, and that factor is quite as likely to be as potent as any other one of equal size. The remoteness of the origin of the inferior blood does not help matters, for the origin of the improved blood is alike remote. Some other method of eliminating the inferior blood must be used, as in-breeding can never do it. If the practice of using pure or improved blood on one side be continued, in time the factor of inferior blood will be so small that practically it will be of no account; but even by this method, a fraction must always remain. If we choose, this small fraction may be entirely eliminated, but not by in-breeding or grading up. If the conditions of the animal are improved, the blood or quality is improved, and thus the inferior qualities eliminated.

In-breeding *per se* can never result in improvement. The wild horse and buffalo are no better to-day than they were a thousand years ago, unless their conditions have changed. By in-breeding, the expert may make some advance by selection; but usually the loss by unavoidable mistakes in feeding and management will more than counterbalance the gain.

We look in vain for an improved breed formed by using the two factors alone. All that may be accomplished by them, unassisted, is to make each individual animal a nearer type of the average qualities of the two or more animals selected for the foundation of the herd or breed. What is gained by selection is ordinarily lost by mistakes in feeding and care. The selected animal is only the expression of the potency of the parents in their most perfect condition. In other words, the result is uniformity, not increase in production, though the animals may command a higher price on account of such uniformity.

Having used all the means necessary to produce rapid development of valuable qualities, and having arrived at perfection, or as near it as possible, how shall the improvement be perpetuated?

It is only necessary to say that the same means used to improve qualities may be employed as far as practicable, to perpetuate them. If the family or breed is superior to all others, there is no way to perpetuate acquired qualities but by in-breeding of families or individuals. This is what Bakewell did, but not till he had so improved his sheep by purchasing the best animals of his neighbors, and by high feeding they were superior to all others. But had his neighbors been doing the same thing, and had they met with like success, he might have made selections from their flocks and thus have avoided the just criticism that his sheep were delicate in constitution and largely composed of fat. Collings and Bates were of the Bakewell school, and largely followed his methods. Charles Colling purchased among other superior cows, one called Stanwick, rechristened Duchess; she is described as being "a massive short-legged beast, breast near the ground, a great grower, with wide back, and of a beautiful yellowish red, flaked color." Is there a Duchess cow to-day that can fill this description? Is there any evidence that Collings or Bates ever obtained a better one of this family by in-breeding?

Mr. Bates purchased Duchess by Daisy Bull, calved in 1800, and also, in 1810, Duchess by Comet. Thirty-one years after the birth of his first Duchess, we find the total number of females of this family bred by him, as recorded in the Herd-Book, to be thirty-two. Meanwhile the results of his in-breeding were so unsatisfactory to himself that he offered Charles Colling $500 for the services of his white bull (151). In 1831, Mr. Bates introduces new blood through Belvidere (1706), and soon is produced the Duke of Northumberland (1940), a bull that has never been excelled, if ever equaled. Mr. Bates continued to breed in-and-in for forty years, and at the end of that time there is recorded 64 Duchess females. Supposing every third calf to be a female, and that they bred at two years old, and then threw off 50 per cent. for death and failures, we should have 2,250 females of the Duchess tribe. I do not desire to dis-

parage in the least the inestimable benefits conferred by Bakewell, Collings, and Bates, but only to show that no improvement in increased productive qualities resulted from in or close breeding. After they had reached their ideal, and had bred animals, as they believed, superior to all others, they endeavored to perpetuate their qualities without recourse to animals outside of the families which had been one of the great factors in the improvement. If this family of Duchess cattle were superior to all others, then the practice of Mr. Bates was the correct one.

I do not care to discuss here whether the acquired qualities can all be perpetuated indefinitely by in-breeding, and whether they may not deteriorate, in time, through the mistakes of the breeder. The practical question for the breeder, at any time, is; Are the cattle of my own breeding better than others? If so, breed-in-and-in. If inferior, then purchase males of those who have been more successful—who have the superior ones.

Finally, in order to perpetuate the milk qualities of a family or breed, the animals must be kept under as favorable circumstances as were those under which the qualities were developed. The selected offspring must be the embodiment of the parents when at their best. The qualities of the sire must never fall below the standard reached, and it matters little whether he be in-bred or "out-bred."

At the conclusion of Professor Roberts' essay President Loring delivered the following address:

ADDRESS ON DAIRY FARMING.

GENTLEMEN: The value of the animal industry of this country has hardly received the estimate to which it is entitled. The universal presence of our domesticated animals has so familiarized us with their existence that we have allowed ourselves to underestimate the importance of the great branch of farming which they represent. We all know that farming without them is an impossibility; and we believe faithfully in the old French proverb, "No cattle, no farming; few cattle, poor farming; many cattle, good farming." From the earliest records of agriculture until now the relations of cattle to the farm have been discussed, and the breeding and feeding of cattle has occupied the attention of the most skillful and intelligent farmers. I doubt if the reason of man in the management of the business of deriving a subsistence from agriculture in its various branches has ever displayed itself more strikingly than it has in the relation, improvement, and care of those breeds of animals which are adapted to his use and from which he draws so large a part of his comfort, convenience, and actual subsistence. There have been inventors, many investigators whose labors have been of vast advantage to the cultivation of the soil. But none of them have performed more important service than they who, by a careful application of the best rules of breeding and feeding, have established valuable families of animals especially adapted to the purpose to which they were assigned—Bakewell and Colling among cattle, our own Hammond, the great improver of fine wooled sheep—the sagacious breeder who laid the foundation of the great family of American merinos.

The question of the raising of cattle with the cost in quantity and the kind of food, and the breeds best suited to different purposes, includes the whole system of cattle husbandry, and is a matter of the deepest importance to every farmer. There is no branch of husbandry so universal, none more capable of yielding fair profits, none more important, none more dependent on good farming, and none more likely to be attended by good farming, when properly pursued. Wherever man resides, whether civilized or savage, whether roaming or stationary, whether on mountain pasture or in cultivated and luxuriant valleys, in good farming regions and in poor, and in every spot where grass grows for cattle "and herbs for the service of man, then the herd attends him and supplies him with food and labor and clothing, and the means of tilling the earth."

By the statistical returns of the census of 1880, there are in the United States 10,356,993 horses, 1,814,368 asses and mules, 999,092 working oxen, 12,442,137 milch cows, 22,466,562 other cattle, 51,183,903 sheep, and 47,638,371 swine. Of these the increase has been in milch cows between 1870 and 1880 from 8,935,332 to 12,402,137; of other cattle from 13,566,005 to 22,466,532; the aggregate of cattle in 1870 was 23,830,608, and in 1880, 35,877,791, an increase of 12,057,183. In the ten Northwestern States the increase in milch cows has been quite extraordinary in the last ten years. In Michigan the increase from 1870 to 1880 was from 250,359 to 384,573; in Ohio, from 654,390 to 767,044; in Indiana, from 393,736 to 504,944; in Illinois, from 640,321 to 865,915; in Wisconsin, from 308,377 to 478,376; in Minnesota, from 121,467 to 275,539; in Iowa, from 369,811 to 854,097; in Missouri, from 398,515 to 661,405; in Kansas, from 123,440 to 418,333; in Nebraska, from 28,940 to 151,609; the aggregate being from 3,289,856 to 5,371,831 or an increase of 63.3 per cent.

These figures indicate the value and importance of the dairy interest which this

convention represents. This interest in the Northwest has been a marvel of progress during the last ten years. It was a great surprise, received at first with incredulity and distrust, when, at the Centennial Exposition, the palm for superior butter was awarded to Iowa. But it was not an accident. In Iowa, in Illinois, in Wisconsin, creameries came into existence, acquired prestige, and commanded prices even above the rates for the standard goods of popular Eastern establishments. Only the fancy brands, the product of a few popular dairies, which command extraordinary prices from wealthy and fastidious purchasers, bear higher prices than the best butter of the Northwest, and a few popular creameries readily obtain to-day from two to four cents more than Eastern dairies of a high grade.

Ten years ago there were more than 3,000,000 milch cows in the ten States of the Ohio Valley and the trans-Mississippi. They are called "milch cows," but with the exception of the Western Reserve, and scattered dairies in the Northwest, milk and butter products were consumed on the farm or in its neighborhood. There has been in ten years in this territory an increase of more than 2,000,000 cows, but comparison of numbers feebly indicates the great advance in the production of butter and cheese. The best milking breeds have been introduced, selection of individuals has resulted in great improvement, and the milk yield has greatly increased, while the animals receive better fare, and skill and science have been invoked in the manufacture. In many districts a new industry has been created in a single decade, in all great improvement in the quantity of milk, quality of product, and the profit in marketing has resulted.

There has been an advance of the dairy interest in all sections of the country, but the enlargement in the West has been more than double that of the East, and in volume vastly greater than the improvement at the South.

In 1870 the aggregate amount produced annually was: Of butter, 514,092,683 pounds; of cheese, 53,492,153 pounds; of milk, 235,500,599 gallons, sold in the market and factories. In 1880 the products of the dairy had increased nearly three-fold, and milk had increased more than two-fold, as the following table will show:

	Yield in 1870.	Approximate yield in 1880.
MICHIGAN.		
Butter.....pounds..	24,400,185	73,200,355
Cheese.....do.....	670,804	2,012,412
Milk.....gallons..	2,277,822	4,555,644
OHIO.		
Butter.....pounds..	50,266,372	100,533,754
Cheese.....do.....	8,169,048	26,507,144
Milk.....gallons..	22,275,304	44,550,608
ILLINOIS.		
Butter.....pounds..	36,083,405	108,250,215
Cheese.....do.....	1,661,703	4,984,109
Milk.....gallons..	9,258,545	18,517,090
INDIANA.		
Butter.....pounds..	22,915,385	68,746,155
Cheese.....do.....	283,807	851,421
Milk.....gallons..	936,983	1,873,966
IOWA.		
Butter.....pounds..	25,512,179	76,536,537
Cheese.....do.....	1,087,741	3,251,523
Milk.....gallons..	688,800	1,377,600

Turning to the eastern section we find the following interesting figures accurately compiled in the census of 1880:

1870. New York, cows 1,350,661
1880. New York, cows 1,437,855
Increase, 6¼ per cent.
1870. Butter of farm dairies.....pounds.. 107,147,526
Cheese.....do.... 22,769,964
Milk sold in market.....gallons.. 135,775,919
In all equivalent to 483,813,465 gallons of milk.
Average per cow, 358 gallons.

188. Butter of farm dairies	pounds..	111,922,403
Cheese	do....	8,362,590
Milk sold	gallons..	231,965,533
In all equivalent to 577,389,097 gallons.		
Average per cow, 402 gallons.		
Vermont, 1870, cows		180,285
1880, cows		217,033
Increase		36,748
Or 20 per cent.		

1870. Butter of farm dairies,	pounds..	17,844,396
Cheese,	do....	4,830,700
Milk sold	gallons..	3,835,840
In all equivalent to	do....	53,104,844
Average per cow	do....	295

1880. Butter of farm dairies	pounds..	25,240,626
Cheese	do....	1,545,780
Milk sold	gallons..	6,526,550
In all equivalent to	do....	84,053,848
Avearage per cow	do....	388

In 1880, Massachusetts produced 6,559,161 pounds of butter; 2,245,873 pounds of cheese; and 15,254,057 gallons of milk sold, being exceeded in this product only by New York and Ohio.

These figures will indicate the great value of the dairy, and the product of milk produced for the daily market, and the importance of this convention as representing a great and widely diffused industry, and called for the purpose of obtaining and imparting information to the farming community. For myself, having laid before you the magnitude of the dairy interest, I beg your indulgence while I submit a few suggestions with regard to dairy cattle.

Many years ago a writer in the Library of Useful Knowledge remarked:

"At the outset of his career the farmer should have a clear and determined conception of the object which he wishes to accomplish. He should consider the nature of his farm; the quality, abundance, or deficiency of his pasturage; the character of the soil, the season of the year when he will have plenty or a deficiency of food, the locality of his farm, the market to which he has access, and the produce which can be disposed of with the greatest profit, and these things will at once point to him the breed he should be solicitous to obtain. The man of wealth and patriotism may have more extensive views, and nobly look to the general improvement of cattle; but the farmer with his limited means, and with the claims that press upon him, regards his cattle as a valuable portion of his property, and on which everything should appear to be in natural keeping, and be turned to the best advantage. The best animal for him is that which suits his farm the best, and with a view to this he studies or ought to study the points and qualities of his own cattle and those of others. The dairy-man will regard the quantity of milk,—the qualtity,—its value for the production of butter and cheese,—the time the cow continues in milk—the character of the breed for quietness or as being good nurses, the predisposition to garget, or other disease, or dropping after calving,—the natural tendency to turn everything to nutriment,—the ease with which she is fattened when given up as a milker, and the proportion of food requisite to keep her in full milk or to fatten her when dry. The grazier will consider the kind of animal most in demand in his neighborhood, the early maturity, the quickness of fattening at any age, the quality of the meat, the parts on which the flesh and fat are particularly laid, and, more than all, the hardihood and the adaptation to soil and climate."

There is one fact, however, which the breeder occasionally forgets, but which is of as much importance to the permanent value of his stock as any careful selection of animals can be, and that is good keeping. All good stock must be raised with care and well fed. It is necessary that these two essentials in this species of improvement should always accompany each other; for without good resources of keeping it would be vain to attempt supporting a valauble stock. It is yet more evident when animals are absurdly brought from a better to a poorer soil. The original stock will deteriorate if neglected, and the improved breed will lose ground even more rapidly and to a far greater extent.

That there is a steady improvement going on in the raising of dairy stock, the figures I have laid before you show conclusively, and yet there is great room for improvement in this direction. Sufficient care is not always used in selecting the female in the first place. A cow that happens to be a good milker, in spite of many bad points, and without any known ancestry, is expected to be valuable to the farmer's herd. A large cow is selected for the foundation of a herd of heavy cattle—her size being often her only

recommendation. She may be a bad feeder, a bad handler, a bad mover, in fact deficient in those very points which render an animal fit for the stall. She disappoints our expectations.

I will not discuss the raising of beef-cattle, with which every Western farmer is familiar, and which is a comparatively simple and easy branch of this business. The production of a herd of short-horned steers of uniform quality and size is not difficult—the shape and structure, and the fat-producing organs being easily transmitted and easily preserved. The raising of dairy stock, however, is more difficult. The organization of a good milking cow is very delicate, easily disturbed, and not easy to transmit. The whole system of milk-producing organs is so sensitive that many causes may prevent its transmission, and many causes may injure its operation after it is transmitted. A sudden chill, a severe thunder-storm, change of food, fright, abuse, may harm but little a thrifty steer on a hill-side pasture, but any one of them may seriously injure a good cow grazing by his side. We should not forget this if we would anticipate our many disappointments and bear them philosophically. We can, however, select good cows for our herds, and exercise judgment and care in breeding from them, always remembering that no matter what the yield of milk from a cow may be, she should not be selected for a breeder unless she possesses as an inheritance that shape which indicates strong vitality and that quality which indicates active secretory junctions. In her well-shaped strong head, wide muzzle, mild clear eye, broad forehead, small waxy horn, slender neck, straight and slender fore-leg, sharp chine, loose shoulder, broad rib, open-jointed back-bone, mellow skin, preponderating hind quarters, long hind foot and broad fore foot, ample carcass, well shaped udder, large superficial veins, soft hair, she should indicate a capacity for converting food into milk as distinguished from that cow whose rounder and fuller form and heavier bone and smoother joints and narrow head and heavier quarters show an especial aptitude to take on fat.

A good dairy cow should possess the appearance of strength and firmness without being too compact, and she should possess no palpably weak point if she is expected to endure well in the work of the dairy. But after the most careful selection it will be found extremely difficult to produce a dairy herd of uniform excellence or of uniform quality. In this respect the most remarkable dairy breeds fail lamentably. The Ayrshire farmer has been engaged for nearly a century in establishing a breed of animals which should conform to the description I have given of a dairy cow, and should possess the faculty of transmitting the best qualities in their full vigor. In this work he has evidently engrafted on the west Highland cattle the blood of many well-known English breeds, more especially the Jersey and short-horn. He has succeeded in creating a good dairy cow, but he has not succeeded in giving his breed of cattle that uniformity of shape and color and quality which makes a breed valuable. He has established analogy but not uniformity. He has secured certain qualities of a good cow contained in animals of every variety of color, size, shape, function, the best of which are good enough for the most critical and ambitious dairy farmer, and the poorest of which are of but little value either for the dairy or the stall. The standard type of this cow is so good that when all other praise of a good medium sized animal is exhausted, the finishing touch is made in the expression, "She is as good as an Ayrshire." The other most important dairy breed is the Jersey—a breed produced in a narrow territory and so carefully bred for generations that there can be no doubt of the purity of the blood. The peculiarities of this animal are always preserved: but closely bred as they are, resembling each other in color, and shape, and texture, and function, they vary in their dairy qualities fully as much as the Ayrshire. From these two illustrations I have inferred that the breeding of good dairy cows could only be done by such judicious crosses as will secure the desired shape and quality, with the expectation that a large proportion of the attempts to produce what is wanted will fail. So far as I have been able to judge, certain grade short-horn families make the best foundation of a dairy herd; and crossing them with good Jersey blood will produce a larger proportion of good cows than any process of breeding, pure or mixed, which I have seen. The cow produced by this cross possesses a large share of those points I have laid down as belonging to a good cow. In this way an inexpensive mode of breeding is secured, and the fruits are obtained at so economical a rate that the rejected animal can without loss be turned to the market for beef.

I have already said that it is comparatively an easy matter to breed animals, which, by their aptitude to fatten, will remunerate the feeder. The qualities belonging to an animal structure designed for this purpose are very perceptible and easily transmitted, and are easily preserved and improved by feeding. Mr. Bakewell learned almost the precise mechanism adapted to his wants as a producer of size and fat; the form and quality of bone; the shape of the parts containing the vital organs and the organs of nutrition; that "feel" which an expert understands so that he may almost be said to carry eyes in his fingers' ends, capable of exploring the internal organization of every animal. And this bone and shape of the body and texture of the skin are easily preserved and transmitted. Breeding does much and feeding does more towards this preservation and transmission. When Mr. Colling saw Hubbard he knew that his stomach and

glandular system and nervous organization all tended toward the development of fat, and he believed it would be easy to transplant such lethargic faculties. He did this on good soil, and with proper care, in making a creation of fat. Mr. Aiton and his predecessors had a very different and a much more difficult task to perform. That delicate organization which is called into operation when the food taken into the stomach is to be converted into milk, is much more difficult to comprehend or control. True, there is a certain physical conformation indicative of a large capacity for secreting milk, but when we remember that this capacity violates all law we can comprehend how many difficulties they labored under who in Scotland endeavored to establish a breed of milkers. They might secure the bony structure, the quality of the skin, the shape of the muscle, the general outline, the form of udder most approved, and after all this there might be some defect in the powers of assimilating the food in the glandular system, in the nervous organization, which entirely destroyed the utility of the animal. This accounts for the wide differences which exist in individuals belonging to every well-known and long-established breed of milkers, such as the Jerseys and Ayrshires.

Now, it would seem that the great rule to be observed in the rearing of dairy stock is not to interfere with the delicate organization by the food furnished in early life. Why cannot the system of a heifer be injured by food so as to disorganize her glandular functions, as well as the system of a cow which can be forced into diseased action with the greatest ease? Why may we not, for instance, lay the foundation of garget long before the udder contains a drop of milk? We do not feed a milch cow as we do a fattening cow, unless we are willing to run the risk of ruining her. For the wholesale statement so often made that what produces milk will also produce fat, and *vice versa*, is shown to be wholly unfounded by a comparison of the effects of rowen hay, brewers' grains, fine feed, and green food, with corn meal and oil-cake.

A dairy cow, moreover, never reaches perfection in her line until she has arrived at maturity; and she must reach this period of life with all her faculties unimpaired, if we expect her to be as good a cow as nature intended her to be. She differs in this respect from the best beef-growing animals, which are mature, as it were, from the start, and whose organizations, instead of being impaired for their business by generations of high early feeding, are rather more and more adapted to it. We all know that the oldest and best families of short-horns are not remarkable for constitutional elasticity and vigor. They have not great muscular strength, are not nervous and powerful in their actions, and are deficient in the procreative faculties. Like the thoroughbred horse, which has also been forced to early maturity and early decay for many generations, they have become enervated and constitutionally delicate. High feeding has done this in both instances, and as "a short life and a merry one" in the animal is most profitable to the breeder of beef and horses fit only for the turf, high feeding has accomplished what was desired, the gain being greater than the sacrifice. Not so, however, with the cow. Her powers mature slowly and depend very much on the strength of her constitution. When this is impaired her value is diminished. For in the work of giving milk in which her whole life is passed the tax upon her vital forces is such that none but the most robust can endure it. In establishing a dairy breed, therefore, early maturity with its accompanying evils is not desirable. On the contrary it should be avoided, and that mode of feeding should be adopted which will be conducive to health in the individual and in the breed, and which will in no way exhaust the powers and shorten the life of the race.

In addition to this, great regard should be had in raising dairy stock to the effect which different kinds of food produce upon the animal economy. Whatever enlarges the bony structure of the female calf beyond what is necessary for her strength is worse than useless. A coarse-boned cow rarely reaches that standard of excellence both in the quantity and quality of her milk which is attractive to the breeder or satisfactory to the consumer. So, too, of fat. The fat cells, that tissue of the body in which adipose matter is deposited, are found in fat and lean animals alike—the difference consisting in the amount of their contents and their number only. For the supply of fat certain organs are provided which are capable of receiving all that excess of non-azotized compounds, such as starch, oil, &c., which is contained in the elementary matter taken into the body. Where there is a ready absorption of these compounds into the vessels, fat is produced, especially if with this absorption there is combined a vigorous power to generate adipose tissue. When they are not absorbed, accumulations of fat do not take place; and when they are absorbed, without being provided with adipose tissue they would accumulate injuriously in the blood, if not drawn off by the liver. Hence it is that in warm climates where there is diminished excretion through the lungs, and non-azotized food is not got rid of by the respiratory process the liver is overworked, its functions become disordered from its inability to separate from the blood all that it should draw off, and these injurious substances, accumulating in the blood, produce various symptoms that are known under the general term bilious.

I have dwelt on the production of animal fat and the organs engaged in its manufacture in order to show how distinct a part of the animal economy it is, and how na-

turally the fat-producing functions can be transmitted independently of all others, and may be cultivated at the expense of all others.

The secretion of milk is a very different matter, and is performed by certain glands whose business it is rather to elaborate from the blood certain products which are destined for the special uses in the economy, and to eliminate matters whose retention in the circulating current would be injurious. Be it as it may, the production of milk is a very different business from the production of fat, and does not result in a combination of the same elements as are contained in the adispose tissue and fat cells.

It is well known, moreover, that the proportion of two at least of the principal ingredients of milk is liable to great variation with the circumstances of the animal. Exercise and cold by increasing the respiration eliminate part of the oily matter in the form of carbonic acid and water; while rest and warmth by diminishing the drain favor its passage into the milk. The proportion of caseine on the other hand is increased by exercise; which would seem to show that this ingredient is derived from the disintegration of muscular tissue. The experience of every farmer teaches him that an animal which has a large, heavy, muscular development, and is thus furnished with the means of rapid locomotion is seldom a good milker. Her digestive apparatus is more devoted to her fleshy fiber than to the preparation of milk. The same may be said of fat and bone. So true is that, in countries where the bone and muscle of the cow are developed by labor, her service in the dairy amounts to but little.

It would seem, therefore, that in rearing animals for the dairy care should be taken that the young are not so fed as to develop a tendency to great size either in frame or in adipose tissue, or so as to establish in the end a race which has every faculty except that of producing milk. I would not advocate a deficiency of food for young dairy stock, but I would argue against an excess of articles of a highly stimulating quality. The plan of the Scotch farmer is undoubtedly a good one—to take their calves early from the dam, feed them from the dish, and bring them to solid food or pasture as soon as the condition of the young stomach will allow. Instead of linseed-meal they use a great quantity of oat-meal—an article of food much less predisposing to fat and keeping up a vigorous growth. We have in this country a good quality of hay, everywhere a basis of feeding; and after the calf is weaned, or after she has had milk enough to give her a fair introduction into life, hay in the form of hay tea, and afterward of rowen, is undoubtedly the best food the animal can have, especially when aided by a few roots, such as turnips or carrots. In such cases milk is abundant at a very early age, and skimmed milk is advantageously used as a substitute. I should not recommend the use of grain, especially that containing a superabundance of oily matter, as Indian corn and linseed for young dairy stock, or even for dairy cows when in the flush of milk. Perhaps corn-meal sparingly or barley or oat-meal may be used in winter should the animal seem not to thrive well. But a calf that is properly weaned and properly fed after weaning, and furnished with a good pasture, will be carried through the first winter most satisfactorily on good, sweet hay, especially rowen, with roots. In this way can a uniform and well-balanced animal be produced, which, when put to dairy service, will not become coarse and raw-boned in her appearance, nor take on flesh at the expense of the milk-pail.

The business of feeding his herd every farmer must learn for himself, with due regard to thrift and economy. Animals in constantly good condition need less food than those that are not, and of this the farmer must judge, remembering that good shelter in winter is as important as good food. It is poor economy to let a cow get into poor condition either in the spring or autumn. In feeding for the dairy I have found that the best winter feed is good hay, with a supply morning and evening of corn fodder chopped and mixed with fine feed and corn-meal, saturated with hot water, and allowed to stand twelve hours. Prepare the morning feed in the evening, and the evening feed in the morning, always covering carefully the box in which the feed is mixed. I have fed many roots and all varieties, but not with that benefit which I expected except in the health of the cow. Turnips and mangolds impart a flavor to the butter; carrots, which are expensive to cultivate, will only impart color without increasing the quantity. You have been instructed here on the value of ensilage, and I shall be glad to know that it receives the approval of practical and economical farmers, who will undoubtedly continue to examine and judge it. Of the value of oil-meal and cottonseed-meal you are all aware.

I have considered the quality of dairy cows, their structure and capacity for the dairy, and the methods of feeding them as the most essential matter to every dairy farmer. I have said the State of Iowa possesses 754,097 cows. If by proper feeding you can increase the yield of milk one quart to each cow, you will easily add one hundred thousand pounds of butter per year to the present product. Add to this the increased number of cows which your farms could easily feed, and you have an industrial resource here of which your State may be proud, as she now is of the energy and thrift which are rapidly receiving that increase. This calculation is worthy of your consideration. The Eastern manufacturer knows that a very slight increase per hour in the product of his mill, or the saving of but a fraction of a cent per yard on his cloth,

will often constitute his profit. So of the farmer. A small addition to each item of a large aggregate of his crops will necessarily yield him a large reward. You will pardon me, therefore, for entering into the mere details of your business as managers of dairy herds. The care of the cream is important, but you must first secure the cream as economically and profitably as possible. The protection of the market against adulteration is all important; but a strong check to fraud is an ample supply of a reliable product. The occupation of the home and foreign market is a matter worthy of your ambition; but we must go first to our cows for our power to supply the market. For the very foundation of this business Iowa has great opportunities. In soil and climate, in pure water and sweet pastures, she is almost unequaled in this land. Together with her sister States in the Northwest, she can reap a great harvest from her herds, and increase largely her prosperous agriculture.

At the conclusion of the president's address the convention adjourned until 2 p. m.

The convention reconvened at 2.20 p. m; Mr. Blount, of Colorado, in the chair.

The PRESIDENT *pro tempore*. Discussion upon the topics presented this morning is now in order.

Mr. FOREMAN, Indian Territory, desired to state why the beef of the Guernsey Island should be considered the choice beef. He asked why the cities of the Eastern States should be the consumer of the inferior class of beef? He had had twenty-five years' experience in handling stock in the West. Poor beef is eaten East, and will continue to be under the present regulations. For instance, you are to ship cattle East. Your herdsman goes out and scours the country and gathers in your cattle that have been there for years. They have never been corraled. They are driven 140 or 150 miles to reach the railroad. Here they are crowded into cars without mercy. The high rates compel the owner to crowd them close. The law says 24 hours to feed. Practice says (and here comes your poor beef) 40 and 60 hours to feed. The speaker had counted 57 dead cattle in a train of 60 cars. Cattle in condition natural to these circumstances is what the East gets for consumption. Best cattle are shipped to Europe. A resolution of the convention, calling attention of the authorities to the law, might be beneficial. Demand that stock shall not be slaughtered before it is dead. He had for years studied the reasons why native cattle were so affected with Texas fever. He found that wherever the cattle are driven to any extent, that, from the fetlock to the knee, will come innumerable small cracks, from which will exude a glutinous substance, and the hair stands right out from it. If the cattle are driven through while the grass is dry no harm will come, but if after the first rain, your cattle are attacked again. He believed if Texas cattle were taken from the grass of Texas, and handled as Northern cattle would be, and not overheated, the native herds through whose country they pass would not be so much affected.

Dr. Loring having resumed the chair,

General JACKSON said: Seeing that the president has come back, I want to touch upon a point or two in his remarkable address, for which I think we owe him a vote of thanks. I want simply to corroborate his views in regard to milch cattle, though we have no dairy and do not sell our milk or butter. We milk about twenty-five cows, principally to supply the negroes on the place. I wish to speak of an old breed of cattle in Tennessee noted for the large quantity of milk they give. It is a cross between the Durham and the Jersey, and gives us the best results as to milk we have ever attained. This cross of the Jersey has

the effect of increasing the quantity of the milk without decreasing the quality, and has given us the very best milch cow we ever had. Now we feed the cows on corn, partly, in the winter, and on cotton-seed and a little good clover hay, which, by the way, is the best hay made on the farm, when properly made. It ripens the same time as orchard grass, and when cut at the proper time and properly cured in the sun is very nutritious. Nothing but the best quality of hay is ever used to feed to these milch cows or work stock. We have found by experience that what contributes quite as much to the milking qualities of the cow as anything else is the fact of her having her first calf at a time when she can get the benefit of green grass, which distends the lacteal vessels. It is so with the brood mare. If you permit your cow or your mare to bring forth her first produce under conditions without abundance of green grass you injure her capacity. I doubt whether there is any other thing that will compensate for the grass. She would not be a good milker unless a good nurser. That I conceive to be a very important point.

I regret exceedingly to have to differ with our worthy Commissioner on one point. The Commissioner thought, as I understood him, that the high feed made blooded horses delicate. I differ from him on that point. It is not the high keeping, but the lack of exercise, which produces this effect. Corn-meal or Indian corn should never, in my opinion, be fed either to the young calf or to the old thoroughbred. No food that is heating in its nature should be fed, but a liberal supply of that that is not heating. In the case of a colt that has been well fed, if he has had plenty of exercise, it makes us a valuable animal. So far from the horse thus raised being delicate, they have grown sixteen hands and two inches high, weighing 1,350 pounds. I never preserved the record as to their longevity, but have known it to extend certainly from twenty-eight to thirty-two years.

Strong mares produce the healthiest foals we have, at the age of twenty-four and twenty-five years. I think the best produce we have ever had was from a mare twenty-two years of age. I simply make this statement in order to make a correction of that point, with regard to the delicacy of the thoroughbreds.

These are the only points that I believe I have made a note of on the two addresses—both admirable, and both listened to by me with pleasure and profit.

The PRESIDENT. The convention will allow me to state one or two matters. I have been quite surprised to find that the address I made this morning was attributed to Professor Harris, for the reason that I made some mistake in using his name instead of that of Professor Roberts, to whom I was referring, or rather indicating, that the remarks which I proposed to make had reference to the subject which he had just discussed. I desire to say that this address was my own, so do not charge Professor Harris with any of my eccentricities or opinions. If I had wanted to crawl out myself, I might have done so and left Professor Harris to bear the brunt of General Jackson's strictures. I do not differ with him; I agree exactly with the facts he states regarding the early feeding and working of the colts, as better to be avoided in this country, to give our horses more power; and in what he says about feeding with corn-meal, I agree with him. No man ever saw a good cow made out of an overfed calf. I can point you to one instance with which I am familiar, the horse Ethan Allen. There never was a finer piece of horse-flesh, and his gait was the finest I ever saw. Horses may pull the sulky faster, but the terrific force of machinery when put upon

the track at two years old, is, as my driver has said to me many a time, fatal in its effects, and many a colt has been ruined by this business. Feeding calves and colts too heavily does not make good cows nor horses.

General JACKSON. The practical results are what we want to get at. I quite agree with the Commissioner that excessive food is improper at any time—but excessive feed without exercise is positively ruinous. I have tried to impress the fact that too much flesh is very injurious. I believe you may wean a thoroughbred colt the 1st of November, and keep him locked up until the 1st of May and get him fat as a buck, and you will find his action seriously impaired; I said thoroughbred, because I am more familiar with them. I believe that the best race-horse in the market, if confined from the 1st of November until the 1st of May following, would present such an appearance that you would only have to look at him to tell that he would soon lose his action, and that that horse, under no possible circumstances, could acquire any reputation whatever. I want to emphasise the fact, that it is exercise that is needed and that that is the important feature of providing that every trotting horse, or thoroughbred, shall each have a stall to himself, so that if he does not exercise enough you can reduce his feed, and keep him in good growing condition.

Mr. CHAMBERLAIN wanted to speak of the paper read by Mr. Roberts. The paper was a success as a burlesque. Possibly as a sober statement of the existing dairy of New York State it may be a success, but as a statement of the dairy cows of Ohio he asked leave to protest; and he thought Colonel Mills, of Elgin, Ills., would protest against it as to the dairy there. When Mr. Roberts says that dairy cows are worth about $15 a head in New York it sounds marvelous to me. I have to state that it would be an exceptional case in Ohio for any cows to be sold at such a price. When he states that the annual income from a cow amounts to $26 a head, I will say to him that he cannot find that to be the case in Ohio. When he mentions $20 or $30 as the cost of building per head, I do not understand how he harmonizes that with the northwest corner of a rail fence. When he got 150 pounds of butter as a cow's yield, and also stated that the value of a calf was but $1, I wanted to inquire whether any cheese was made in addition to the butter, or, if not, what was done with the skimmed milk, and if fed to the pigs, what became of the pork; if fed to the calf, why should not that be counted as a part of the proceeds? As to his argument in favor of the better breeding of dairy cows I agree with him, and I am glad to inform the professor that that work is already begun in Ohio, and he can find there cows the income from which is $26 or $32, but he will have to give $50 for them at least.

Mr. SMITH. Will the gentleman say what number of cows was in the dairy he selected as an illustration, and what the product of that dairy is, and then divide it so that the product of one cow may be determined?

Mr. CHAMBERLAIN. I know it is asserted that figures do not lie, but I must confess that in my opinion there is nothing that lie worse. In Ohio the farmers are compelled to give to the assessor the number of cattle they own, and they must swear to the correctness of the statement. If I have twenty-five cows and put in twenty, my neighbor reports it; knowing this we are pretty careful, and by this means we get a pretty accurate account of the number of cattle. When the tax-assessor makes up his list of personal property the number of these cows is given, but when he has ascertained this he starts out forgetting

to ask how much butter they make: so that there is no accurate information showing the quantity of butter made in the State, and there is no method of determining the quantity that is produced.

Mr. J. M. SMITH. Can you gentlemen give me the net proceeds of a cow, or of a dairy of cows, where the entire product of the milk is delivered to the factories?

Mr. CHAMBERLAIN. I want to finish what I was saying about our dairy in Ohio. I cannot give any detailed statistics showing these points for my own county, but I will state that S. Strait & Son produced more than double the amount per cow of product stated by Professor Roberts.

Dr. LORING. What is the average price of butter per pound in Ohio?

Mr. CHAMBERLAIN. The average price of S. Strait & Son was 28 cents, and cheese about 10 cents per pound.

Dr. LORING. I want the market price.

Mr. CHAMBERLAIN. It was 25 cents.

Dr. LORING. What is the price of milk?

Mr. CHAMBERLAIN. About one cent per pound for factory milk.

Dr. LORING. Is that all?

Mr. CHAMBERLAIN. That is all, where they sell the milk to the factories.

Dr. LORING. They carry it to cities to sell sometimes, do they not?

Mr. CHAMBERLAIN. Yes: for the wholesale product; the retailer is paid about six cents per quart.

I was going to say that S. Strait & Son produced double the amount that was credited to the entire county by the reports. I have noticed repeatedly that the figures are entirely below what is correct. That proves conclusively how unreliable the statement we have just heard must be, since it is founded on those reports. And hence the fallacy of these figures. Not half the product of these counties is given. The number of cows is correctly given, but the product is not half given, and this is one of the causes of the injustice done to our dairy. The average per cow from the books of Strait & Son for a whole season—the gross receipts—were $50 per cow for the whole factory, and that is exclusive of the winter butter and cheese made at the farmers' homes. Now, I will read what Byron Hawkes says:

> Began eight years ago with cows that made less than $30 apiece at the factory, and by crossing with pure Durham bulls, from known milk stock, the dairy this year, 1880 (consisting of ten grade Durhams), milked, in eight months, with nothing but grass to eat in the summer, 16,462 pounds, an average of 1,646½ pounds per cow, and the calves sold for $7 each at time of birth. The cows have made in eight months, counting the calves, a little over $35 each. The milk was sent to the factory of M. Goss & Co., of Rochester, Lorain county, Ohio. The dividend of the factory was a little over $1 a hundred.

This is an example of what the dairy industry amounts to in the West.

Mr. BROWN, of Indiana, said: Twenty years ago they began in this State with scrub cattle. First Devons, then short-horns, and recently Ayrshires were introduced. Indiana has, within the last decade, increased her milk stock over 40 per cent. He concurred with Professor Roberts's physiological deductions. One thing must not be lost sight of. These are creatures of habit. It will, of course, add to the vital force of the cow to give it four months of rest from milking, but you are establishing the habit of being dry four months that will be transmitted to the offspring. It is important for those who want milk to avoid this. It can be done by giving richer food, and extending the

nutrition in order to maintain the vital force against the drain of the milk.

The PRESIDENT. Whoever wrote the essay which I delivered this morning [laughter] took especial pains to get the best and most reliable figures in this country. The doors of the Census Office were open to him to go in and take all he could find, and he did so. Now, I stated that of butter there was in Ohio 100,533,754 pounds, valued at $25,133,434; cheese, 24,507,144 pounds, valued at $2,450,714; milk, 49,550,608 pounds, valued at $4,955,068; total, $32,559,266.

This makes $41 per cow. Now, in addition to this, there is a very large amount of milk yield in the large towns. In Massachusetts it is an immense trade, and it must be in Ohio. I think it would be safe to say that the average of each cow in Ohio is $50. Then, I think we ought to estimate the calf as worth a little more than $1. I get $2 for mine. Now, gentlemen, let us go still further, and estimate the manure, for its value ought certainly to be taken into consideration. But even at $50 each it is a good investment on the money.

Mr. BROWN. May I inquire whether that includes the domestic consumption in the farmer's own family?

The PRESIDENT. I have no doubt that the real product of Ohio is considerable, and it should be estimated also.

Mr. CHAMBERLAIN thanked the president for the figures. He thought there should also be added the calves that are raised for dairy purposes, and for beef, therefore, $50 would not begin to touch it.

Professor ROBERTS had left many facts open, hoping to call out discussion rather than to treat the subject exhaustively. There were a dozen subjects in the paper, upon each of which a book could be written. Mr. Brown had misunderstood him relative to the perpetuation and development of milk qualities. He thought the animal should be made to produce all that she could, consistent with health and vigor, until her habits were formed and could not be changed, and then he would modify her life a little to provide for the offspring. In returning from a dairyman's convention in New York two years ago, a factory man who manufactured the products of 800 cows told the speaker that many of his patrons did not average over $24 per cow. He had divided the cows into three distinct classes—one that causes a loss of money, one that vibrates between gain and loss, and one that makes all the money there is. What he recommended was to cut off the heads of those that run the farm into debt. In sections of New York he could buy for $15 a head, and they could be found in Ohio, Illinois, Iowa, and all over. He had put them at $32.50, and next spring he could buy 10,000 calves at $1 per head. He wanted to show that in New York there are 500,000 cows running the farmers into debt, and 500,000 out of which money is being made. In regard to the manure, Professor Roberts considered the manure of a cow, if properly fed, worth $25 per year.

Mr. CHAMBERLAIN. I desire to ask you whether you think the statement you made about New York is a fair average? Were there not as many cows not in the dairy owned by small farmers—five, six, and seven in number—and is not the amount earned by these cows as large as the amount earned by the dairies?

Mr. ROBERTS. There is, of course, much milk produced in that way. I do not know how it compares in quantity to that sold to the factories.

Mr. CHAMBERLAIN. Do you think you could buy those cows for twenty-five dollars?

Mr. ROBERTS. I could get some at twenty-five dollars.

Mr. CHAMBERLAIN. I know of friends of mine there, who keep from seven to ten cows, on their farms, and consider them worth seventy-five dollars; of course, every cow will not average as high as that. The number of cows in the dairies does not give the right average for the whole State. I think that is where the difficulty and the trouble is. I have no way of getting at these facts, other than by statistics, and by the books of the dairy-men. When I get at the books of a dairy-man, I get some figures exceptionally large, and some exceptionally small. In the first case, the production of the sixteen thousand pounds of milk from one cow, and in the second place a gross product of only twenty-five dollars for each cow.

Mr. COBB said: A good many keep but one cow. The product of that cow is half of their living. A friend in Illinois, for instance, had sold $125 worth of milk from a cow in one year. We do not get at all the facts from the dairy statement as now made. The cows supply the people of the country with a large part of their living.

Mr. HUBELL. Will the gentleman state what breed the cow belonged to which produced 16,000 pounds of milk in a year, which makes 50 pounds of milk in a day for three hundred days, a circumstance so abnormal as to be difficult of belief, and certainly affording no basis on which to build up a theory for practical guidance. We should not select extreme cases, but rather average conditions, as the basis for our selection of modes of procedure.

Mr. ROBERTS. I wish to read a brief extract, from an essay on the dairy, written by Hon. X. A. Willard, of Little Falls, New York:

> I know that there are many dairy-men in the Eastern and Middle States who complain that no money has been made in dairying at last summer's prices, and they doubtless speak the truth from the standpoint of their own experience, but I cannot believe that it is necessarily so. It is a humiliating thing to acknowledge, and yet it is a fact susceptible of proof, that the mass of dairy-men have not improved the milking qualities of their herds during a long period of high prices, but, on the other hand, they have allowed their herds to depreciate in value by using refuse cattle from droves, rather than in breeding stock on the farms. When cheese brings from 15 to 20 cents per pound, and butter from 40 to 50 cents, cows that yield 300 pounds of cheese, or 100 pounds of butter per year, are supposed to turn out some profit, but when prices fall to this year's rate it is found that these inferior herds do not pay expenses.

Mr. COBB, of Illinois, and Mr. Aiken, of South Carolina, discussed the viciousness of Jersey bulls. Mr. Aiken explained some of the qualities of the Brahma cattle. He finds them very valuable, but they can't be confined. They hardly have their equals in milkers—one cow giving 32 quarts per day.

The committee appointed to wait upon Senator Morrill, with reference to certain features of his educational bill, made their report. A spirited debate followed, which, by resolution passed on Saturday, January 14, was ordered expunged from the records.

The resolutions were laid upon the table.

The PRESIDENT. There remains to be presented a sketch of the Signal Bureau work for the agriculturist, and an essay upon the more perfect organization of the agricultural interests, by Dr. R. T. Brown. The chair reminds the convention that to-morrow commences the convention on cereals, and this question of Signal Bureau work really involves so much the question of crops, that I think it would be wise to have that paper during the series devoted to that subject.

Mr. Jackson coincided with the president's views, and spoke of the vast importance of the service to agriculture.

The PRESIDENT. Then the first essay to-morrow will be Mr. Birkheimer's paper, to be followed by essays on the "Improvement of cereals,"

"National and International crop reports." "Inspecting and grading of cereals." [After a conversation with Mr. Blount.] At the request of Professor Blount, his essay will be first in order to-morrow morning.

The convention then, at 4.48 p. m., adjourned.

SATURDAY MORNING, *January* 14, 1882.

The convention was called to order at 10.40 o'clock.

Mr. FERNALD, of Maine. Mr. President, inasmuch as the resolutions presented near the close of our session yesterday afternoon gave rise to a little discussion which was regarded as slightly of a political character, and in order that the records may be entirely free from anything that has even the suspicion of a discussion of such a nature, I desire to move that the resolutions and the discussion which ensued be omitted from the records.

The motion of Mr. Fernald was adopted.

Mr. CONNOR. I wish to offer this resolution:

That it is the sense of this convention that the revenues arising from the sale of the public lands should be appropriated to the institutions established by the donations of the government.

In making that motion, Mr. President, I desire to say that these various institutions have their base upon that kind of public policy, but I cannot see what objection could arise to the further sale of the public lands, the proceeds to be appropriated to the further endowment of the institutions which have been established upon this line of policy.

The PRESIDENT. The chair will state that the resolution, with the whole subject, was carried to the table and lies there. The first motion, therefore, in order to raise it, would be to take it up from the table.

Mr. CONNOR. Then, Mr. President, I make that motion.

The motion was not agreed to.

The PRESIDENT. The first paper before the convention will be that on the "Improvement of cereals," by Mr. Blount, of Colorado.

Mr. BLOUNT. What I have to offer this morning by way of the improvement of the cereals, will be, perhaps severely practical, not theoretical, from the fact that all my dealings with them, and with the seeds thereof, have been practical and not theoretical. I have attempted to put the most grain on a single stalk of wheat, and I have attempted to lengthen the heads and improve its elements in two ways—make the straw stiffer, adapting it to different climates and soils and different modes of cultivation. I have attempted to improve the grain in the wheat as well as corn, and what I wish to say to-day will be in that line entirely. I have disregarded fertilizers from my experiments, from the fact that I wished to test the virgin soil, soil of one and two years old, and so on.

The rules I observed in this experiment were identical with those observed by the stock breeders, with two exceptions: one is the crossing must be artificial in crossing the cereals. In the stock department they do it naturally. I will not mention one-fourth or a hundredth part of what might be mentioned here with profit, in the province of the paper I read.

IMPROVEMENT OF THE CEREALS.

By Mr. Blount, of Colorado.

At the present day the cereals, under the common mode of cultivation, yield only about seven-sixteenths of their real capacity within the cereal belt of our country. Were the whole area of the United States included, the maximum yield would stand at a much lower figure.

Wheat, oats, corn, barley, rye, and rice constitute our cereals.

Corn and oats are not particular where they are planted; they will grow and try to make something. They are really indigenous to every State; in fact, they flourish in all their beauty, luxuriance, and usefulness anywhere between tide-water and snow-line.

Wheat, barley, rye, and rice are much more eccentric in their habits, preferring certain soils and climates to develop their essential properties for man and beast. * * * The Great American Desert, which includes the agricultural portions of Colorado, is fast becoming the leading section, especially for wheat, oats, barley, and most of the vegetables. To raise these costs much less than elsewhere, the crop being much surer and the yield greater.

In the first place, up to this time, no fertilizers whatever have been used, the character of the soil and water being such as to preclude the necessity of this expense. Secondly, no loss is sustained from the effects of drought, the system of irrigation being so perfected that every crop of the wakeful farmer receives its due amount of moisture. The expense incurred by irrigation does not amount on an average to more than 50 to 500 per cent. of the losses sustained from drought and wet. The expense of preparing the soil, sowing, cultivation, and harvesting is less by 150 to 200 per cent. than in wooded sections. The yield, too, is much greater.

So far as their adaptation to soil and climate is concerned, as well as to the wants of man, corn heads the list. It possesses all the properties of the others, and more—it has an abundance of oil and the power to resist all its enemies.

Wheat is full of eccentricities, made up of whims and freaks. In some sections it promises one day to make the farmer a millionaire; the next, these promises are all blasted by blasted heads and rusty blades. In money value, wheat is king: indeed, of so great value is it that corners are built upon it here and there, and large supplies are exported to the remotest ends of the world.

Corn is general and universal, reaching in its uses and provisions farther than all the rest.

Every man can raise corn, but every man cannot raise wheat. Now, it is a fact we all recognize that half a crop is not made in the cultivation of the cereals the country over. Why? Every one can give a reason. It is the object of this lecture to give mine in a few practical remarks.

Records and well-authenticated reports show that 102 bushels of wheat, sown broadcast, have been produced per acre (I. S. Ray, Montana); that 108 bushels by special culture (F. F. Hallet, England); that 791 pounds from one pound of seed (A. I. Scoggins); that 1,500 pounds from one sown (A. E. Blount); and that 576,340 grains, per 47 pounds and 7 ounces, have been produced from one grain, by division, resetting, and cultivation (C. Miller, Cambridge).

Records also show that 296 bushels of shelled corn have been raised on one acre (C. J. Cox, Selma, Alabama); that 64 ounces have been produced from one kernel (Compton); that 3 bushels and 9 pounds from 100 stalks (A. E. Blount); that 63½ ounces on one single stalk (A. E. Blount). Now, if, with a little science and extra culture, the capacity of wheat and corn can be strained up to these figures, is there not room for doubling the averages by the ordinary method of cultivation?

It is hardly necessary to say that there is ample room. It is one of the strangest things to my mind why this gaping chasm has not long ago been bridged. In the first place I shall attempt to show where the first abutment should be put in, taking wheat to begin with. Seed wheat as generally used now-a-days is hardly fit for chicken feed, say nothing of using it for seed. It is degenerate, impure, imperfect, full of parasitic *fungi* and simply ruinous to the farmer and to our health.

Up to this date there are in the United States over 350 different varieties of spring and winter wheats; among all these that have become standards are found typical and genuine grain, true to name—which any farmer with an eye to improvement and profit must see in his ripening crop. This genuine grain, which is always found in the largest stools—those that come up evenly together and ripen uniformly, he should select and pick *himself* and sow on choice land, cultivate, harvest, and put away under lock and key to be again sown, cultivated, and harvested by *himself*, that no meddling can interfere and no mixing can take place. * * *

"He who by the plow would thrive,
Himself must either hold or drive."

This is the first abutment I would put in the bridge, the first step toward perfecting a wheat by the pedigree system, the same system adopted by F. F. Hallet and many other intelligent and successful wheat growers of our own country.

By following the rules by which it is successfully carried out and observing the natural laws that govern vegetable growth wheat can be made to double the length of the head, increase the grain 100 per cent., its powers as much, and its quality will be so greatly improved that one will hardly recognize it as being the same kind after three years' improvement.

To breed up a wheat (if I may use the expression) to a degree that will develop its full power is a work almost any observing farmer can carry out. It is not a laborious task but one of persistent effort, and therefore one of great profit.

In carrying out this system in the improvement of wheats, I adopt nearly the same rules and laws that govern stock-men in breeding in-and-in. The pedigree system does not in any way create new varieties; it only improves, making two blades, as well as two grains, grow where but a poor individual grew before.

The system of cross-breeding is by far the better of the two, from the fact that wheats can be made to suit any soil and climate as well as to contain any or all the elements essential to success in the field and in the mill. The operation of crossing one wheat upon another is comparatively easy. But the work to be done before and after crossing requires much tact and calls into requisition all one knows of vegetable physiology and the art of combining elements.

One must be well acquainted with the character, habits, elements, and strength of the two varieties to be crossed before breeding in order to know what properties to develop and what habits to discard. He must know the strength of the female as to her power to reject the enemies that infest wheat, and he must know the quality of the male as to the grain. After the cross has been effected the same knowledge is necessary, but it must be exercised with greater force and discrimination and with severer tests, that the offspring containing the better qualities may be nourished and the worthless rejected. In the operation of crossing there does not appear to be much science; anybody can cross two wheats, and may succeed in producing a pretty good variety once in one thousand trials; in some respects he may obtain the qualities desired, but it will be an accident.

The effects of crossing wheats are wonderful; sometimes so wonderfully disappointing that the experimenter is astonished at the outcroppings. For instance, a smooth wheat is crossed upon a bearded, or *vice versa*. The experimenter is in a quandary when he beholds the result to know whether he or nature could have been at fault in bringing out such a mingled mass of ingredients. As the heads begin to issue from the sheaves he is dismayed at the irregularity, the appearance of such a diversity of forms. There are heads of various lengths and various shapes—some bearded and some smooth, some half around and some half smooth, some like both parents and some like neither. The straw, and leaves, and chaff, too, are completely transformed, possessing the characteristics of both parents, besides some elements more likely to have belonged to the dark ages. The grain as well undergoes changes least thought of. They seem to have been jostled together in complete confusion, struggling to see which, the higher or lower, characteristics shall get the ascendency. In the midst of this combination of forces reversion plays a very active part. The tendency backward is greater than the tendency forward.

The offspring being now in his hand, the experimenter is again compelled to bring science to his aid in selection. All grain possessed of bad and undesirable qualities is rejected, and the good is sifted and tested again and again. Tests are applied for starch and other elements to obtain its status as a milling wheat. The farmer, too, must be satisfied. He must raise it under different circumstances, in different soils, in different climates, for ten years before he can tell whether or not it is a profitable kind for him to raise.

This medley of circumstances taxes the sharpest eye and calls to the work chemical skill that we may know with what properties we are dealing.

On account of the difficulties attending all this work the crossing has been called by some hybridization—a misnomer.

Improvement of wheat in this line is attended with much patience, care, and skill. After the offspring have been brought out they are subjected to much severer tests. All having no fixed color or form are rejected, and those having the desired characteristics and qualities are again tested, &c. Sometimes an experiment can be satisfied in three years by the wheat becoming "fixed;" sometimes it takes four and even ten years to combine all the properties in their proper proportions. My note book shows the fact that some varieties will easily cross one upon another, but will not cross another upon one. For instance, foreign wheats cross readily upon ours, but ours fail to effect a cross upon them.

I am aware that many theoretical writers—and among them I find one or two botanists—are of the opinion that new varieties of those cereals—called hermaphrodite—can be made by selection. James S. Lippincott, of New York, in an extended article on

the geography of plants (Agricultural Report 1863, 464), takes that ground also. Lindley, Klippart, Mannd, and Raynbird, entertain the same opinion. I cannot conceive of a new variety being produced within itself any more than in-and-in breeding produces a new race. As I have stated before, selection improves but never produces.

In making new wheats by crossing, I will state again a strong female should be selected as to stalk and blade, and as to the grain, a strong male. In other words, the female should have strong, stiff straw, well glazed, and good milling properties, and the male should be possessed of the same qualifications, with a grain that has at least 12 to 14 per cent. gluten. Now, in all this work, especially in that pertaining to the improvement of wheat by the pedigree system, there is one serious drawback, not noticeable alone in the cereals, but in all improved vegetables and seeds. Every advance forward in line of improvement opens the door to a ruinous deterioration—that is, when highly improved grain is put into the hands of the common farmer, who never cares from what source his seed comes, how it is saved, or of what kind it is, retrogression is certain. Neglect and bad management at that crib, as well as at the stock-pen, always stand prominent. The most highly improved and finest grain has a tendency to revert to the original—yes, and back still further will it decline if a single loophole is left open. * * * Both Von Krous and Knight believed in the degeneracy of plants. The former believed they tended to revert to their original state, while Knight believed in absolute decay. Knight believed that plants would cease by a natural statute of limitation. Von Krous believed they only fell from grace.

In the system of cross-breeding this is not the case, or at least deterioration is not so rapid and ruinous. Crosses, or hybrids as they are called, when once fixed, retain their powers and good qualities many years, even when badly handled. Hundreds of English wheat growers condemned Hallett's pedigree wheat because they said "That while he doubled the yield, the grain was proportionably coarser, and the flour inferior."

In our own country this may give rise to the question whether it is better to strive to double our crops with the prospect of making them coarser staring us in the face, or content ourselves with the trifling average now reported. For one, I am by no means satisfied with small yields and poor quality. When I cross wheats or corn, I always intend to take all the bearings beforehand, in order that the acre that produces 40 bushels will yield as good quality as the acre that makes 5. * * *

Inasmuch as a great work is left in the natural world for man to do, I intend in all my experiments to make art outmaster nature in this line.

It is the same in the vegetable kingdom as in the animal—the poorer and coarser the individual, the more prolific when neglected and permitted to revert or run wild. For instance, when the Australian wheat was introduced into Colorado, it produced well and made most excellent flour. Now, it produces more and the flour is third or fourth grade, the gluten having decreased to but 7 per cent. On the other hand the hybrid standards are, in the hands of skillful farmers, producing 30 to 60 bushels per acre of the finest of grain for field and mill.

You will now ask what is obtained by all this labor. I answer, much! Please examine and test the flour of to-day made from the hard wheats like the Fife Defiance, Russian, Mexican, Pringle's and Arnold's Hybrids, Oregon Club, and others, and the flour of the old Mediterranean, Diehl, Gennesee, and others of 1850, and I can assure you that where skillful and scientific hands have had the management of the standards the flour is 100 to 500 per cent. better, and the wheats as much in all respects.

One word more about wheat. Enough wheat is wasted in thick-seeding to supply the whole wheat-growing population the year round. Repeated experiments in Europe and in our own country have proved beyond a doubt that every pound of wheat sown can be made to produce a bushel—in other words, that 30 pounds the country over is enough seed for any acre, if put in properly and sown at the right time. I am aware that there are many opposed to thin seeding, nevertheless the physiological make-up of the wheat-plant, its nature and habits plainly show that it must have room to develop its powers (the greatest enemy to wheat is wheat), hence in all cases under favorable circumstances, thin seeding has never failed to produce greater returns than thick. So far as the cultivation of wheat is concerned, my experience shows that on an average one cultivation will produce enough more grain to pay for the extra labor twice over.

Of corn but a few remarks by way of improvement. Professor Beal, in his admirable lecture on Indian corn, has covered the whole ground of its history, utility, and culture. In addition, I would mention a few items of interest.

Wheat, as I have already stated, is hermaphrodite or bisexual, having both stamens and pistils in the same flower and on the plant, while corn is monœcious, having the stamens in one flower (tassel) and the pistils in another (silk), both on the same plant. Exposed as these generative organs are, the plant flowers easily and is fertilized by the agency of insects, wind, and force of gravity. In wheat, mechanical means have to be used to produce a cross, but in corn mechanical means have to be used to prevent crossing.

The ease with which all corn mixes has produced varieties without number, in fact

it may be said there are none pure, none genuine, none true to name. There is no limit to the changes that can be made upon corn.

By selection, as in wheat, the stalks can be made shorter or taller and more uniform, the blade more symmetrical and regular, the shanks less objectionable and more limited, the husk wider and longer, the cob smaller and stiffer, the grain more regular and uniform, and the habits of the corn much better in adapting itself to soils and localities.

By crossing one upon another kind the color, texture, form, quality, and the whole individual can be changed by the experimenter. For instance, should a mongrel be wanted four kernels of different varieties can be planted near together, one kernel white dent, one yellow dent, one kernel pop-corn, and one sugar. Should all these four kinds tassel and silk at the same time, each would be fertilized by the pollen of its three neighbors, but not by its own, making thereby the offspring a mixture in proportion to the amount and strength of pollen received from the other three. On neither kind would there be found a single kernel exactly like either of the four planted, from the fact that corn does not generally fertilize itself. No one variety can be made to suit all localities on account of its habits. The farther north corn is raised the shorter the stalk and the more flinty the grain; while the further south the taller the corn and the softer the grain. Should these two extremes be united the means would include New York, New Jersey, Pennsylvania, Ohio, Indiana, Illinois, Missouri, Iowa, and so on to the east line of the Great American Desert. This belt constitutes the section in which corn can be raised to the best advantage, at the least cost, and at the greatest profit. Corn can be improved in many ways. First, by making use of seed properly selected.

All seed-corn should be selected in the field, because there and there only is it possible to obtain the seed true to name, and possessed of the desired characteristics. Only in the field can perfected ears and perfected stalks be found together. Seed-corn should be taken from different parts of the field, to make the relation as remote as possible. Seed-corn should be picked from those stalks that bear the greatest number of ears, to make it more prolific.

Seed-corn should always be selected from the top ear of those stalks that bear the largest number, because on the top ear is always found the genuine typical grain, the other ears below not having developed sufficiently to produce good seed on account of an insufficient amount of pollen. Seed-corn should always be saved from those stalks that ripen earliest, to make the season of its maturity as short as possible.

Seed-corn should be taken from well-formed ears, tapering uniformly, with straight rows, because they are more easily and better protected by the husk, and bear more grain in regular than in irregular and crooked rows. In breeding corn in-and-in every ear designed for the propagation of the species intact, should be protected by a covering of thin muslin before the silk appears, to keep insects and the pollen of foreign and barren stalks away.

The difference in planting corn selected in this manner, and that taken from the crib, is wonderful and wide. A hundred per cent. in favor of the selected seed has been reported in hundreds of cases, prominent among which are the experiments of E. S. Carman, of the Rural New Yorker, Dr. Sturtevant, of Massachusetts, and others.

In every cornfield is found an enemy too little noticed by almost all farmers. It comes in the shape of corn itself; is ruinous and baneful in the extreme. This enemy is seen in all parts of the crop in the shape of thrifty stalks without ears—barren stalks, they are called.

The pollen, which is very abundant, degrades every ear it fertilizes. Being so abundant it is distributed far and wide, and its deteriorating effects are plainly seen year after year more and more. The careful and vigilant husbandman is aware of the deleterious effects of these intruders, and at an early stage cuts them away.

Oats, barley, rye, and rice claim none of our attention at this time. Oats, barley, and rye grow so easily, so naturally in most sections, and are so prolific, that time spent on improving them may not be so well spent as upon the more valuable and finer cereals. In Colorado 70 to 90 bushels of oats are frequently raised per acre, and what is better, they weigh 40 to 50 pounds per bushel. In the Rocky Mountains, just above us, rye grows wild. Two rows barley produces from 40 to 50 bushels per acre, and is so little in demand that attention given to its improvement, we think, is wasted.

Upland rice received from Japan is now being raised successfully in many sections, and will pay, I think, in some localities.

Much more might be said upon cross-breeding and hybridizing, but they are not within the province of this essay.

The Chairman *pro tempore*, Mr. BLOUNT. The next essay that will be read is No. 4, which the chairman has directed to be read in the place of No. 2. The subject is the better organization of the agricultural work, and the essay will be read by R. T. Brown, of Indiana.

THE ORGANIZATION OF AGRICULTURE.

By R. T. Brown, of Indiana.

Though the people of the United States represent nearly all the varied forms of productive industry, yet agriculture engages the largest part of our labor, employs the greatest amount of our capital, and is the great fountain of supply for our wealth, whether individual or national. Commerce and trade may accumulate wealth, but farming, manufacturing, and mining alone can create value. But agricultural capital is widely diffused, and its production is distributed among millions of producers, each contributing his imperceptible rivulet, so that as a financial force it produces scarcely a perceptible effect on our State or national legislation.

The rain drop that falls from the cloud is scarcely felt when it strikes the earth, yet these combine themselves into a mighty river, and rushing down the precipice of Niagara, its force simulates Omnipotence. In a popular government like ours, if the agricultural interest and capital of the country could be so concentrated as to act as an unit, it could easily control and direct legislation, and mold the destiny of this great American republic. Yet I would not advocate, nor do I believe the farming interest requires such a patronage from the general or State governments as would promote the prosperity of agriculture to the injury of any of the great sisterhood of industries. But it is a duty we owe to farming as the business that feeds and clothes the millions and the monarchs, that we so unify its widely scattered interests as to make its powers felt, at least so far as to secure its protection from the encroachment of what would seem to be the conflicting interests of other industries, and to secure a fair share of whatever the government may legitimately do to advance the interest and promote the prosperity of her citizens. To secure this end, agriculture, as the leading industry of this nation must be organized. But what the wise fathers of the republic saw in regard to civil government, we can more distinctly see in regard to agricultural organization. The national organization must be a complex unit. The British island may represent the agricultural interests of that people in a Royal Agricultural Society, and France may gather the farming interests of that republic around a Grand Agronimic Institute at Versailles, but this nation which bids fair, at no distant day, to number a hundred populous States, largely devoted to agriculture, must, in its central organization, represent States rather than individuals. Our agricultural organization, though loosely held together by a feeble bond, has proceeded on a correct principle. In most of the States we have county or district societies, each with its president, secretary, treasurer, and board of directors; and of these suborganzations are formed State boards with their proper officers and machinery; but here the organic force appears to have exhausted itself. At the other extremity the general government has begun the work of organization by creating this department of Agriculture with its several divisions, and furnishing these with a fair outfit in the way of library, cabinets, and apparatus; and in addition to this department, Congress has, quite liberally endowed a polytechnic school in each of the States, where agriculture, mechanics, and military science shall be taught.

Now in the State boards, the agricultural school, and this department we have the elements out of which may and should be constructed a complete and efficient organization of the great agricultural forces of this nation, and such an one as would accommodate itself to the indefinite growth of our population, and development of our agricultural resources. We have thus the material prepared, and the time has fully come when we should proceed to the construction of a grand industrial edifice in which the prominent feature should be the productions of the soil. But I shall not attempt to photograph that magnificent structure; sufficient at present to say that such a relation should be established and maintained between the State boards of agriculture, the State agricultural colleges, and this national Department of Agriculture as will result in a division of labor, so that one in ignorance of what the other has done, or is doing, shall not repeat the same work. Agriculture is peculiarly an experimental science, and the art is yet largely tentative.

A few principles are well established as to the cultivation of the several crops, and the treatment of different soils; beyond these lies a vast territory that has yet to be explored by careful experiments.

To this work of evolving principles and laws by experiment, it is not a very industrious and successful farmer who is adapted, and if he were, he cannot afford to devote his time to this work, in which every other farmer has an equal interest with himself, and in which all should bear an equal share of the burden. This is pre-eminently the work of the experimental farms generally attached to the agricultural schools. First, because these are, or should be, controlled by men qualified for conducting experiments, observing results, and deducing conclusions from them; and second, in this labor he will be instructing his pupils in the important work of experimenting. But in this work there should be concert of action, and to this end there must be consultation and

assignment of labor to each agricultural professor. Let this be accomplished by a meeting of all the operators in this line, and a general agreement as to what is to be done, and who is to do it, with regard to the whole field of experimental work. When the work is done, let the results be tabulated and reported to the respective State boards. This information, added to that gained from the county and district reports, and that collected at the annual fair, should be transmitted to this department, where the whole should be carefully digested, and the essential facts established by the several State reports, together with what the department may have gleaned from foreign correspondence, should be published in one or more volumes and distributed through the State and county organs to the individual farmer for whose use they were made.

But the prominent defect in our present organization, if such it may be called, is the want of a proper coherence and concert of action between its several parts. At present the Department of Agriculture, which Congress wisely designed to be the head of a great national organization of agricultural industries, is completely severed from the working members of the body of which it was designed to be the directing organ and great sympathizing center. The county and State boards of agriculture know but little more of the doings of this department than they do of the edicts of the Emperor of China, and it is but fair to say that the ignorance and want of sympathy is mutual. Men prominent in the State organizations hardly know there is such a body as the Department of Agriculture. A stray volume of its annual reports which some candidate for re-election to Congress has sent to his bucolic friend to secure his influence, or an occasional sneer at the department in his political paper, are his only sources of information; and the Commissioner has scarcely any better opportunities to know of the doings of the State boards and agricultural colleges. In this state of non-relation, if not alienation and antagonism between these elements of a common interest, there can be no concert of action nor recognition of mutual dependence.

In organizing this central department, Congress failed to comprehend the vast extent of our country and the immense magnitude of the agricultural interests. To fill the Congressional ideal of his duties the Commissioner should, like the fabled Argus, have a hundred eyes, and like Briareus, a hundred hands; or to speak without a figure, he should be in intimate relations with all the agricultural interests and forces throughout the whole nation. Personally, this is impossible; but Congress should provide for a deputy commissioner in each State, who should be the connecting link between the State and national organizations; through him the department would be advised of the movements, the success, and the failures of the State organizations, and through him the State boards would learn, not only what was being done here in the way of introducing exotics and acclimating them, but as well what was done in all the other State boards and on the State experimental farms, and at the various experimental stations in Europe. This deputy should attend all the meetings of the State board and of the executive committee, and should be present at the State fair, noting every mark of progress, and every defect as well; and should faithfully report all that he sees and learns to this department, that through it the information may be transmitted to all the other State societies. He should be in intimate relation with the agricultural college, and should frequently visit its halls and its experimental fields, and from time to time report his observations to his principal; in short, he should industriously give his whole time to the duties of his station, and should be compensated accordingly. I am aware of the objection that will be urged against completing our agricultural organization on account of the expense it will involve.

To foster and encourage the productive arm of this nation—the arm that feeds its millions and fills its coffers—will not require more than ten per cent. of the annual appropriation we make to pay the Army, which, at most, only guards our interests, often against an imaginary danger. The magnitude of the farming interests in this nation, and the ridiculous pittance annually appropriated to advance that interest, is among the absurdities of these times that posterity will wonder at.

As has been already hinted, a more perfect division of labor, both of production and of marketing the products of the farm, will be one of the beneficial results of organizing our agriculture. This will cover not only the experimental department, embracing the best mode of culture, kind of crop, variety of seed, time and method of planting, best implements for cultivating and saving the crop, but it will also involve the question of farm statistics and the best mode of collecting and digesting these, so as to make them of value to every farmer. The subject of transportation as collateral to the profits of farming will also demand a share of attention. Each of these must be assigned to its appropriate agency that every one may know his proper sphere of work. Now, in our disorganization, each local society, to some extent, is attempting this whole range of duty, with the result of but little progress.

The subject of collecting crop statistics is one that has elicited a lively interest and called out much animated discussion. Indiana has attempted a solution of this problem by State authority, with the prospect of satisfactory results. It is proper to say that crop reports at best can be but approximations toward the truth, but these affect prices materially when published. Grain dealers have been accused of manipulating

statistics, and sometimes fabricating them, so as to greatly exaggerate the crops and reduce prices in first hands. On the other side, farmers' clubs and agricultural societies have undertaken the difficult task of fixing the size of an unmarketed crop. And now, as might have been anticipated, it is hinted that farmers have an interest in underestimating the crop; and therefore, the legislature of Indiana, proceeding on the maxim that

"All mankind are very weak
And little to be trusted,
Itself the wav'ring balance shake,
It's rarely right adjusted,"

made it the duty of the township trustees, under oath, to collect and report the crop and other statistics to a disinterested bureau, where they shall be tabulated and published by State authority. Thus far our experiment has worked well, and if we succeed in keeping our bureau of statistics out of the hands of speculators we will be able to present as reliable statistics of farm products as the nature of the case will admit of, and in doing so we will point the way to relieve the agricultural organization from a difficult task and a grave responsibility.

On the whole premises the outlook is hopeful. Agriculture as an art is old: as a science it is but an infant, and if we succeed in our effort to place the art under the guidance of science we will greatly diminish the drudgery of the farm and vastly augment its productiveness.

THE PRESIDENT. I have received a communication from the acting commissioner of the Choctaws, Chickasaws, Cherokees, Creeks, and Seminoles—the Five Nations—asking for seeds from the department. It has suggested to me that General Porter could give us some interesting statistics upon the cereal capacity of the Indian Territory. Therefore an invitation has been extended to General Porter, and I have the pleasure to announce that he will present such a paper at 2 o'clock on Monday. I have had a request from some of the delegates present, to confer with the representatives of the railroads in regard to procuring a reduction of the return rates for the members of this convention. I have been unable to make any arrangement of that character, on account of the great number of routes. The fact that there are not enough delegates going on any one road, prevents the securing of such a reduction. I think if such a request had been made before the assembling of the convention it might have been done.

Professor INGERSOLL. Inasmuch as several present may like to hear the report of the Signal Office with regard to agriculture, and as I am much interested in meteorological work, having seen for myself what they were trying to do for the benefit of agriculture, I should like to hear the essay on that subject. I therefore move that this essay be now read.

The motion was agreed to, and Lieutenant Birkheimer read the following paper:

SKETCH OF THE WORK OF THE SIGNAL SERVICE BUREAU FOR THE AGRICULTURIST.

BY WM. E. BIRKHEIMER, *First Lieutenant Third Artillery, Acting Signal Officer.*

The preparation of an essay on the subject of meteorology as it affects agriculture, which I understand was asked of me by this honorable convention, is a task that would require time and research to properly perform. A moment's reflection will suffice to show that, unless a person came prepared to do so, the presenting of such a paper, worthy of this assembly and occasion, would be an impossibility. The preparation would have required months, even years, instead of days.

Those who wish profound views on this subject, strengthened by the results of years of observation and experiment, enriched by the copious light of the philosophic mind of the writer, will find the papers of Professor Henry, published from 1855 to 1859 inclusive, a fountain whence they can draw both propositions and ideas based on facts worthy the age in which we live.

The publication of Mr. J. Lawrence Smith, of Louisville, Ky., on meteorology and the cotton-crop, is said to be a valuable contribution to this class of literature.

Blodget, on the climatology of the United States (1857) and the additional matter of later date, published by the Smithsonian Institution, the Agricultural, and other government departments will be found replete with valuable thoughts and suggestions.

Of foreign works on this subject the text-book on climatology of Lorenz and Rothe, which deals particularly with agricultural questions, ranks among the first.

To these sources among many others the student of meteorology in its effects on agriculture may turn for information.

While, therefore, an essay such as requested cannot be furnished, it has been thought that a statement of what the Signal Service Bureau has been and is doing for agriculturists might not be without interest to the members of this convention.

The meteorological division of this bureau was established in 1870, pursuant to joint resolution of Congress, approved February 9 of that year. The act provided for the giving of warnings to stations on the lakes and the sea-board of the approach and force of storms. The meteorological division in the first instance, therefore, could be considered as organized only for the benefit, directly, of commerce.

On November 1, 1870, the first weather-bulletin was published.

By act approved June 10, 1872, the Signal Service was charged with the duty of providing such stations, signals, and reports as might be found necessary for extending its research in the interests of agriculture. In executing this law it was found at first that the means of reaching the interior were meager and precarious. The proposed methods of communication with the stations were new to the telegraph companies, but obstacles were gradually removed so that in fact as well as by act of Congress, the Signal Service Bureau after June 10, 1872, commenced to devote a large part of its energies to serving the agricultural community.

A weekly chronicle of meteorological facts and data was commenced August 29 of this year; its object was to give a general summary of the meteorological conditions of the country for comparison with agricultural and other statistics, and generally to furnish information to those who wished to profit by the labors of the bureau, working with its new and increased facilities. Almost simultaneously with the publication of the Weekly Chronicle was sent out to the farming communities the Farmer's Bulletin, intended expressly to serve the interest of agriculturists.

Subsequently the Weekly Weather Chronicle was discontinued, and was succeeded by the Monthly Weather Review, which is still the standard periodical published by the bureau. Originally this was intended to present a general view of meteorological facts, particularly those showing the progress of storms, but in 1874 the scope of the Review was very greatly increased by the transfer to the Signal Service of over 500 volunteer observers, who had hitherto been reporting to the Smithsonian Institution, and of over 100 Army post surgeons who had been reporting to the Surgeon-General. The amount of data thereby accumulated, particularly that which is of interest to the intelligent agriculturist, is very great, and is all concisely summarized. This periodical is filled to a great extent with an immense mass of minute details on such subjects as the flowering and ripening of plants and grains, with facts attending the appearance of frosts, rains, floods, tornadoes, &c., within the scope of the field of observation, which, in 1874, due to the causes above-mentioned, covered well that part of the United States east of the Rocky Mountains, and, though with fewer stations, the territory west of that range. All atmospheric phenomena, whether taken cognizance of by the instruments, or the senses of the observer, are faithfully collated, summarized, and sent out from the office to those whose interests such information could serve; prominent among those who have drawn on this store-house of meteorological knowledge have been agriculturists and agricultural institutions.

While listening to the interesting papers read before this convention, and the no less interesting discussions arising thereon, the thought has often came up how much satisfaction gentlemen engaging therein—professors, farmers, investigators—would derive from perusing, as they appear month after month, the facts set forth in that Review. Nor is it intended for the learned and scientific alone. The results of investigations and observations are presented in graphic weather charts within the easy comprehension of the unscientific portion of the community. This periodical is, in fact, so well adapted to the wants of those interested in meteorology, both in subject-matter and style, that it has served as a model which several nations of continental Europe have copied for similar publications.

The condensed form in which tri-daily Indications and the special Bulletins are issued is a circumstance greatly to be regretted, but at present it is a necessity, in order that it may be possible to disseminate them. This distribution is done by telegraph, and, whether paid for by the United States or by the Associated Press, calls for the most economical use of words consistent with a clear expression of ideas.

The records of the bureau show that agriculturists, to an equal degree with any other class of the community, desire and are furnished with the tri-daily Indications and special Bulletins. To meet the needs particularly of the agriculturist the bureau has, since 1872, published the Farmers' Bulletin before alluded to, the name indicating precisely the object for which it is issued. It contains the indications of the

weather for the district in which the station is located. These indications are telegraphed from the Washington, D. C., office at 1 a. m., and foretell the weather for the next succeeding 24 and 48 hours, reaching the rural population, for whose behests they are intended, from 12 to 40 hours before the time they cover expires.

Accompanying these indications for the district is a bulletin giving all facts of importance connected with the conditions of the atmosphere over the whole country taken as one mass, and viewed at one and the same instant of time in all the parts thereof. The general laws accompanying weather changes in the United States are given in the Farmers' Bulletin in clear yet simple language. Still further, the direction of winds that observations have characterized as wet or dry for that particular geographical district is therein set forth. In fact, there is compressed into this small sheet a great deal of meteorological information that is of interest and service to every thinking, intelligent agriculturist before whom it is placed.

It will not be forgotten that the reports to make up the information thus given out to the farmer come from Sydney, in Cape Breton Island; Roseburg, in Washington Territory; San Diego, California, and Havana, Cuba, as well as from 150 intermediate stations. This area is 3,000 miles long and 2,000 miles wide. By the telegraphic system of the bureau, observations, first placed in cipher to condense them into the smallest number of words, commence, within fifteen minutes of the time they are taken, to converge, by various paths, on the central office in Washington. When the wires work well an hour sees the last report in, and this time may be shortened or lengthened, depending on the telegraphic service. They are translated fast as received at the central office. The mass of data, systematically arranged, is placed before an assistant to the Chief Signal Officer whose duty it is to deduce therefrom forecasts of the weather. This duty is completed at about 12.45 a. m. Then commences the dissemination of the Indications and special Bulletins to the principal cities and rural printing stations where, between 3 and 4 a. m., the Farmers' Bulletins are found printed, addressed, and at the post-office ready for distribution. As a means for diffusing general knowledge on meteorological subjects among thinking 'agriculturists who cannot profit by the Farmers' Bulletin because of the isolation of the farm, or for other reason, the publications of the bureau are placed within easy reach of all who desire them for a sum in each instance equal to the cost price to the government of the material with which they are printed.

The work of watching, recording, and giving timely warnings by wire of the rise and fall of rivers was early in its history undertaken by the Signal Service. Stations were established with gauges to mark the fluctuations of the waters on the Savannah, Tennessee, Ohio, Mississippi, Missouri, Columbia, Willamette, the Sacramento, in truth on nearly every river of the United States, the valleys of which embrace interests, agricultural or otherwise, influenced by the rise or fall of their waters. In case of extraordinary floods the river observers are authorized to telegraph information to those interested lower down the stream without first referring the information to the central office. On the Pacific coast this is always done.

By this system of river reports, timely premonitions of the great freshets that annually visit the Mississippi Valley, with the changes of the waters of that river, can be given, and thus, in a measure, its levee system be protected, with the immense agricultural interests depending thereon. As with the Mississippi, so with the valleys of the other rivers, each with its agricultural, commercial, and manufacturing interests more or less extensive.

For some years attempts were made to furnish the people of Texas warnings of the approach of "northers," which, if their effects are not anticipated, sweep with such disastrous consequences over that and the country adjacent thereto on the north. During last summer a cordon of reporting stations was completed on north and west sides of a portion of the territory visited by these storms, and a systematic plan for giving notice of their approach was inaugurated for the benefit of Southern Nebraska, Kansas, the Indian Territory, and Texas. The plan for carrying out this scheme consists in sending notifications of the approach of northers to certain telegraph centers on the railroads traversing those districts. From these telegraphic centers the railroads order the notifications to be distributed to the stations on their respective lines.

Notifications similar to those sent the railroad centers are also furnished the officer in charge of the military telegraph lines, San Antonio, Texas, and by him sent to all stations under his control. As these warnings can generally arrive from 12 to 24 hours before the onset of the storms, agriculturists, ranchmen, and others, who are situated so as to receive notifications thereof, are enabled in a greater or less degree to provide against their effects.

This system of warnings is very popular with those whose interests it is intended to serve. It will be extended in scope as facilities for doing so are made possible with the Signal Service.

In 1877 the bureau was invited to co-operate with the United States Entomological Commission in collecting and summarizing all obtainable data relating to the origin, habits, the flight, and devastations of the grasshoppers or locusts which blight the face of

the country in some western sections, like is related of the plagues in Egypt. All stations of the Signal Service west of the 93d meridian and east of the Rocky Mountains were directed from March to November to report, "the date of appearance of the locusts, the direction from which they came, the direction and velocity of the wind and state of the weather at the time of observation, &c.," and generally all information which, when systematically arranged and studied, will aid the entomologist to foretell with more or less certainty the undue and periodical return of noxious insects, and particularly the western locusts.

It is now one of the regular duties of observers of the service in the territory afflicted by this scourge to make report of all facts connected with these insects, with which they may become cognizant. Much of the data given to the public in the Report of the Entomological Commission was furnished by the observers of the Signal Service, and an important contribution to the subject of the hatching of locusts' eggs, based on our observations of temperature, has been made by one of the assistants to the Chief Signal Officer. During the summer just past, every preparation was made, through the regular and many volunteer observers, to have reports furnished the office of the movements of grasshoppers and locusts, but it is agreeable to report that in no instance has any mention of damage been made, although the insects made their appearance at a number of stations of observation. Probably in future years opportunity will offer to practically apply the system of prediction of flights of grasshoppers that has already been matured.

In 1879 a system of frost warnings for the benefit of the sugar industries of Louisiana was commenced. It consists in transmitting from the Washington office to the sergeant at New Orleans, notifications of such cold waves as will probably extend over the sugar-cane section, carrying with them reductions of temperature sufficient to cause killing frosts. The sergeant spreads the information, both through the press and by telegraph, to those interested in this branch of agriculture.

A service similar in all respects to this, but for the benefit of the orange growers of Florida, was initiated this past winter. Notifications of anticipated frosts are sent to the sergeant at Jacksonville; he, when directed so to do, telegraphing the warnings to Sanford in that State. From each of these places, as centers, news is distributed by all available means to those interested in orange growing. The warnings, as a rule, arrive from thirty-six to forty-eight hours in advance of the cold wave.

During 1881 a system of reports of considerable magnitude was instituted for the benefit of cotton interests in the South. Ninety-five stations furnished readings of maximum and minimum thermometers, and of rain ganges. The stations of observation were distributed pretty evenly over the cotton-belt, at least as much so as was practicable. The railroad and telegraph agents, with the consent of their employers, acted as observers. The cotton belt was divided into thirteen districts, each with its center for the collecting of reports; these centers being located at cities where were regular Signal Service observers; this precaution was necessary because of the duty devolving on the centers of consolidating and disseminating reports. The 13 districts were formed into 3 divisions, each with its center to still further facilitate operations.

Observations were taken at 6 p. m., local time, put into cipher, and transmitted to the center of the geographical district in which the station was located. Here a mean of the maximum, a mean of the minimum temperatures, and a mean of the rain-fall for the district is made up, and sent to the main centers of the respective divisions. The main centers, Atlanta, New Orleans, and Memphis, interchange reports, and then distribute them to the centers of districts. By this interchange of reports all the prominent cities of the South are supplied with information daily as to the temperature and rain-fall in the cotton-belt. Published in newspapers, bulletined at cotton exchanges, and other prominent places where business men assemble, this data comes quickly under the eye of thinking, interested men of the community, at these centers, or within the scope of their daily newspaper circulation.

The same information gathered and consolidated for longer periods of time, for a week, month, a year, or several years, could convey through the columns of weekly papers, monthly periodicals, and statistical tables, useful knowledge to the farmer as to the temperature and rain-fall that belongs to his or any other district of the cotton-belt, or of the belt viewed as a whole.

It is proposed to begin the service again this year, commencing April 1, 1882, and extending to October 31, 1882, with 140 reporting stations.

At the solicitation of wheat and other grain growers in the Northwest, the Chief Signal Officer has it in contemplation to institute a service similar in idea, and perhaps quite like this in detail, and in the interests of the grain growers of that section. When it will be put in execution is at this time undetermined; such schemes cannot be inaugurated in a day or week and operated successfully, but any delays that occur in the carrying out of this plan will be unavoidable.

With a view to rendering the Signal Service more valuable to the agriculturists of the country, regardless of sectional limits, the Chief Signal Officer has proposed to the

governors of the several States the organization of State weather services which will be authorized by State legislation, and co-operate with the Signal Service in the collection of meteorological data.

From this system of reports we will be enabled to determine more fully the minute local peculiarities of climate of each section, and the Agricultural Department will be able to furnish the farmers with information bearing upon the culture of crops in the different sections of the country.

In the organization of the State weather services it is proposed to have at least one observer in each county who will report, by mail, at the close of each month to the chief of the State weather service, and from the reports received a monthly review of the weather will be prepared by the chief of the State weather service. Copies of the review will be furnished to each observer and to each county paper for publication. The results obtained from the local weather service will be furnished to the Chief Signal Officer of the Army in time to be made use of in the preparation of the Monthly Weather Review of the Signal Service, and will also be accessible to the Commissioner of Agriculture. Local weather services have already been organized in Iowa, Missouri, and Nebraska, and the organizations in the other States are awaiting the actions of the State legislatures.

There has existed a difficulty, and it exists now, in conveying warnings of storms or other useful information promptly and quickly to the farmer on his farm—when away from the telegraph line or the post-office, where the a Frmer's Bulletin is displayed. There have been a variety of methods proposed by different persons for overcoming this difficulty. One man suggests a signal be displayed on the passing railroad train. Another proposes to erect a very high pole on which to hoist a flag, light, or other signal so all farmers within sight of it may take warning. One proposes small balloons and lights. Another proposes to fire off cannon and thus propagate the news as to weather changes, floods, &c.

These are only illustrations; there are many other suggestions of a similar nature. The weak point in all these schemes, so far as the Signal Service Bureau is concerned, lies in this: that these persons, being irresponsible, would exercise their volition, hoisting signals or not as suited their convenience or fancy; and if mistakes are made by them, the community and the bureau suffer without means of redress. In the important matter of storm warnings, the bureau must have perfect control; unless this be so, the service will be compromised.

It is the earnest wish of the Chief Signal Officer that some methods may be devised whereby the service may be rendered more practically useful in preparing the farmer in his home for changes in the weather; so as to put him more nearly on an equality in this respect with those who have the advantage of telegraphic or telephonic communication.

If the honorable members of this convention can suggest any measures looking to this end, measures whereby the Signal Service Bureau can become more useful to the agriculturists of the country, the Chief Signal Officer will be glad to be favored with them. He will give them careful consideration, prompted by the desire to render the service of which he is the head directly useful so far as it is possible to the agricultural interests of the whole country.

The PRESIDENT. The Chair would suggest to the convention that a committee be appointed, to confer with the Chief Signal Officer, and after considering this paper, be instructed to make suggestions in a report to the convention, based thereon. The paper is a very valuable one, and if the benefits arising from the present work can be extended beyond those mentioned in this paper, it would be yet more valuable. The suggestion is made to me that the tobacco crop is exposed to injury from frosts, and a warning would save the crop from freezing. There are many valuable crops which could be protected from frosts by prompt warning. I suggest this in order that there may be inquiry in regard to this subject, with a view to the further action of this convention relative to their protection. These frosts are readily foreseen, and a little warning will save a good deal of property in that direction. I suggest that it would be in order for the committee to confer together, and then consult with the Chief Signal Officer.

Mr. ROBERT BEVERLY said: The revenues derived from tobacco are over thirty millions of dollars, and a warning of frost twenty-four hours in advance of its approach would often save at least one-half of the crop. I hope the subject will be fully discussed, so that the Signal Officer will be able to determine what protection can be afforded.

Mr. HOLMES said: As regards a very extensive tobacco region in North Carolina, he would very much like to see something of this kind. There the crop has suffered considerably, and anything done by the bureau for the people will certainly be of great advantage to that State, and to the advantage of every tobacco section. I move that a committee of five be appointed to examine the paper read by Lieut. W. E. Birkheimer, entitled, "A sketch of the Signal Bureau work for agriculturists," and consult with the Chief Signal Officer thereon, and thereupon report to this convention.

The motion was agreed to.

Mr. THOMAS TAYLOR, microscopist of the department, made a statement of some investigations he had made relating to the red rust of wheat, botanically known as *Trichobasis rubigo-vera*. These spore he stated were very small, measuring only about one-thousandth of an inch in diameter, but they multiply with great rapidity under favorable conditions. It is a matter of interest to the farmer to know what this rust is, what conditions are favorable to its growth and what will destroy it. Mr. Taylor states that each individual spore is the germ or seed of a distinct plant (a fungus), and that when it makes a lodgment on the leaves of grasses it subsists on them as a parasite, checking their growth. In order to test their powers of resistance to the action of various chemicals he submits them to the action of corroding liquids, then places them in a favorable condition for germination, and by the aid of the microscope, it is at once seen what class of chemicals will operate most beneficially in killing the spores. But a similar class of experiments is made on wheat-grains, and if it is found that while the chemicals that destroy the germinating powers of the rust have no evil effect on the seed-wheat, the chemical best adapted is selected for future experiments.

For sixty years past wheat has been washed with weak solutions of metallic salts, such as common salt, sulphate of iron, sulphate of copper, and sulphate of soda; but in all such cases the corrosive action of the substance used is very slight and by no means destructive to them. In fact weak solutions of these substances have a fertilizing value under many conditions, and *fungi* will grow in profusion on them.

These facts led Mr. Taylor to the conviction that washing the seed with these solutions would be of great value, by removing rust spores from the seed, since the spores in the washings, although not killed, would not find their way readily to the wheat fields, and in this way the destructive effect of the red rust would be greatly mitigated. He found as the result of experiment that seeds generally may be treated with sulphuric acid of commerce, full strength, without injury to their germs, while the spores of *fungi* and microscopic eggs of insects are completely destroyed. He had made many experiments in this line. Beans and pease he treated with sulphuric acid until the hulls shriveled, but they always germinated, and cotton-seed subjected to the action of strong sulphuric acid until the cotton fiber on their hulls was converted into a gummy mass germinated in 30 hours afterwards in a temperature of 80° Fahrenheit. Wheat and other seeds were severely treated with sulphuric acid, not with the view of aiding germination, but rather to test their acid resisting power in contrast with that of the spores and eggs of parasites generally. Mr. Taylor, in conclusion, recommended in all experiments of this kind to treat first on a small scale.

Mr. BLOUNT had had a large experience with rust in wheat. For three years he had tested this smut, rust, and mildew question. He thought he could control rust as easily as smut, which is controlled by sulphate of copper, provided it is not in the soil. The rust is atmospheric, not

in the soil. It may be left on the stubble of the old wheat. It turns from red to black and extends in long streaks, and this is the time it injures the wheat. The only way to avoid the rust is in the first place to improve the blade; second, improve the stalk, and make the application after the wheat is two, three, or four inches high, because the rust is atmospheric. Sulphate of iron or blue vitriol will destroy these spores.

He advocated planting on high, mineral land, and the application of from one to seven bushels of common salt. If this is applied to soil having 20 per cent. of silica, 99 out of 100 crops will be good. He had experimented with 36 varieties of wheat. Three years ago 30 of them rusted badly and he lost much of his crop. He applied salt and sulphate of iron, and no rust appeared. Low land produces more stalk, more rust, and more imperfect and shriveled grain, whereas planting on high land and the use of salt will make good crops.

Mr. RANDOLPH HARRISON, of Virginia, did not pretend to have scientific knowledge of practical wheat cultivation, and hoped it would not be regarded as presumptuous if he questioned the views maintained in the paper. First, as to the hybridization of wheat. I understood him to say that he regarded it as mechanical and not a work of nature. I think he is wrong, and that it occurs sometimes through the influence of nature. From whence have we obtained the many varieties that we had before this artificial fertilization was furnished? For instance, Tappahannock, a smooth red winter wheat, which is a variety of the Genessee flint introduced in Virginia by Bouton. He introduced this wheat in that neighborhood and sold it at five dollars a bushel. Mr. Harrison obtained one bushel of it, and it holds its own with him. The exchanges and the use of new varieties take place in all improvements, and one of these hybrid varieties he had cultivated and found it utterly worthless. Artificial fertilization is very rare in his section. I have tried to mix two different kinds of wheat, and so secure a mixture for use. I think there is great advantage in this; it fills up the chinks, as it were, and then the whole will be fertilized by the foreign matter there. Though I could discern no form of hybridization going on it did seem to me to be going on. It had been long a mooted question also how much seed to use. He would like to hear something on that point.

Mr. CARTER, of Virginia, said one of the most successful men he ever knew was a thick sower, using 2½ and 3 bushels of wheat to the acre. He thought about 1½ bushels is right. We have not found that thick seeding, with less cultivation, will produce more than thin seeding with more cultivation. It is a very significant fact that men urging this thin seeding have not succeeded in it: I mean by that using less than a bushel. Colonel Carter had used three-fourths of a bushel for seeding and then did not make as much as that otherwise seeded. His land is light, and had no silica in it. Of course we know the stiffer the clay the heavier will be the yield.

Mr. SCHWITZER spoke of the importance of selecting wheat. Very much depends on the quality and quantity of gluten. Gluten is a generic name, not known as a chemical, but which comprises vegetable fibrine and glutine. Flour, to make good bread, must have a certain percentage of gluten. Seed should, therefore, be selected having large percentage of gluten—12, 13, or 14 per cent. In the West a great many raise Clawson wheat, because it produces two or three bushels more per acre. Millers in Central Missouri pay 2, 3, and 5 cents less per bushel for this variety, however. The miller desires wheat that makes the best flour. He wants wheat the hull of which is thin, and sufficiently elastic to be shaved off in the process of milling. While exporters get

the same price for wheat irrespective of the quantity of gluten, yet the speaker thought the time would come, and very soon, when grain will not be bought by bulk or weight, but by the percentage of gluten. It is desirable, in order to obtain the best price, to raise wheat that embraces these points. It is a matter to which chemists should give some thought. More attention should be given to the growing of wheat with reference to this characteristic.

Mr. BLOUNT replied to Mr. Harrison, of Virginia. He would not say that the hybrid could not be made naturally. There is a small insect that may sometimes creep in between the clumps between the wheat grain and transport the pollen from that into another. Hybridization dates back 300 years. We now have in this country 350 different varieties of wheat. In reference to thin and thick sowing, he would say that on an experimental plot, he had planted one ounce per square rod, one-half of which seed he had soaked in blue vitriol, the other half being planted as it came from the machine. He raised 18 bushels and 6 pounds from 48 square rods. It was sown in double rows, 12 inches apart; then a space of 2 feet; in this space he run an irrigating furrow. It was so thick it would hold a hat. On a field he had planted 76 grains, and had obtained therefrom 10¼ pounds, or at the rate of eighteen-hundred-fold. With regard to the hull, he said that they pretended to raise hard wheats, but they don't. Every wheat he receives is soft; but jus as soon as it comes to Colorado it grows hard, because of the dry air and alkali, which is conducive to wheat growing. "If you burn 1,000 pounds of wheat, you have 15 pounds of ashes. Those ashes contain about 33 per cent. of potash and soda. We have a Glauber salt called alkali, and that is the secret of our wheat raising." Referring to the husk of wheat, Mr. Blount said that the millers in Colorado put the wheat in a bin of water, where it is soaked three or four hours. From that it is carried to the top of the elevator, and let fall through the air into another bin, and from that into another ten feet below, soaking the wheat three times before they put it in their mills. It comes out two clean pieces of bran.

The time having arrived for recess, the President appointed the following committee to take into consideration the work of the Signal Service Bureau: Holmes, of North Carolina; McBride, of the District of Columbia; Blount, of Colorado; Buchanan, of Virginia; Peabody, of Illinois. And then, at 1.06, the convention took a recess.

The convention was called to order at 2.50 p. m., Mr. Blount, of Colorado, in the chair. He announced a continuation of the discussion on cereals to be in order.

Mr. INGERSOLL referred to the changes which wheat undergoes when grown for a certain length of time. In 1877 the question of the growth of Clawson wheat was raised at the State (Illinois) Agricultural College, and the result of observations when published was to raise the price of Clawson wheat 10 cents a bushel. Previously the millers had been decrying this variety as a poor wheat, but after these chemical examinations had been made the millers suddenly found that it was as good as any other brand. It was found that Clawson, which had been growing for three years in one locality, had improved in its qualities, and an analysis showed that it was better than that grown on other soils for a less length of time. So with the Diehl variety; at first the millers found fault, but after growing it for some time it was found to produce a better milling variety of wheat.

Dr. ELZEY, referring to the quantity of seed wheat to be sown per acre, said that for the locality of Virginia he had found six pecks to

the acre to be the best. He commenced with one peck, and increased one half peck to each acre until he reached three bushels. The largest yield was from six pecks, the smallest from three bushels, the two varieties experimented with being the Fultz and the old-fashioned blue stem white. He finds the matter subject to very considerable variation in different soils. The whole thing rests upon the tilling of the grain in different soils. He referred to the importance of the selection of seed for increased quantity of product, but the results, as given in the essay from such selection, were hardly probable. If Mr. Blount had had forty or fifty parallel rows and planted non-selected and selected seed, and the selected had yielded one hundred per cent. more, that would have been striking.

Mr. CHAMBERLAIN wanted to offer an objection to a conclusion deduced from facts stated without sufficient precision. He would be sorry to have some of the conclusions reached by this very able body go out with the indorsement of this convention, in regard to the quantity of seed to be sown. The gentleman before him made an allusion to this question, which is an old one. It has been discussed often before without getting as far as a satisfactory verdict. My view is, that on first or second bottom land a sufficient quantity would be, on a good soil, from one peck up to nine pecks. In Ohio the practice is to use between six and seven pecks at the agricultural college, and the same at the college in Tennessee. My own opinion is, that about six or seven pecks is the best quantity. I wish also to take exception to the statement that in Colorado they are independent of a drought, contrary to natural laws. Last summer, while in Denver visiting a friend, the president of the agricultural college had called on him for advice, and during the visit he made this remark: "Last summer we had no rain, and in consequence, we did not get a good stand, as we call it. I went all over that portion of Colorado. I saw and heard but one estimate or opinion, and that was, there would not be over twenty bushels to the acre in that Territory. I shall, therefore, take exception to the statement. I shall prefer Ohio, where the rain performs the work of irrigation, rather than Colorado."

General JACKSON. I would like to inquire of the gentleman who has just taken his seat if six pecks to the acre is, in his opinion, the best for purposes of seeding?

Mr. CHAMBERLAIN. Yes, sir; there is another entirely incorrect statement that I want to call attention to in this matter of land. One gentleman spoke of the necessity of having a certain percentage of gluten, both of quantity and quality. Increasing the amount, as suggested, would make twice as much, while if they increase to five hundred per cent. that would make flour worth twenty or thirty dollars per barrel. It is not at all likely that the value of the flour could appreciate in this ratio.

Mr. BROWN thought that some varieties of wheat raised on different places will produce different results in the amount of gluten. He had planted Clawson wheat and white Alabama wheat, and on examination of both varieties, some grown on upland unmanured land, and others grown on bottom lands well manured, some on manured uplands, he found the gluten in some varieties varied as much as five per cent., and the conclusion he reached was that the whole soil abounded in nitrogenous qualities, and that there is a larger amount of gluten where the larger amount of nitrogen exists; so that there is something in the soil which determines the quantity of gluten.

General JACKSON said: I wanted to ask a question of some of these

gentlemen, whose experience in the cultivation of wheat is so valuable· I would like to say, in regard to the difference in the yield where the seed are broadcasted or drilled, that I understand that the general preference is in favor of drilling. How many bushels do you use to the acre, sowing in that way?

Mr. HARRISON. I think I stated that there was considerable difference in the soil in the two cases referred to, one of the soils being a little stiffer than the other, but there was no cultivation in either case. I have never known more than three or four cases of after cultivation. I agree with the gentleman from Ohio (Mr. Chamberlain), who has decided upon six pecks as the best quantity for seeding on Ohio sandy loam. Where the thin seeding was practiced, the yield was as good as ever; but in this case it should not be as thin as shown from Colorado. I should recommend from three pecks to one bushel, if it is a very large grain.

Colonel BEVERLY, of Virginia, was very much surprised to see so great a difference of opinion on a question of this character. He had been cultivating wheat forty-one years, and makes from twenty to thirty bushels of wheat to the acre, and if he had to abandon the drill he should abandon the cultivation of wheat. He was satisfied, from a long and careful experience, that it will make an addition of from twenty to twenty-five per cent. in the wheat crop in Virginia. They are subject to winter-killing frosts, or thawing one week at a time during the whole winter. The last winter was an exception, as we rarely had a thaw. By drilling seed, it is deposited in a trench, and the filling of the trench places it together. It sinks deeper in the spring, and does not become exposed; in broadcasting it springs up and stands out on the ground. As to thick or thin sowing, he had experimented on that, and he thought about three pecks to the acre was sufficient, if a man is particular to distribute it properly.

Mr. HARRISON had seen better crops of wheat from broadcasting than from the drill. He had seen them side by side.

Dr. ELZEY. Have you tried them with reference to the effect of drilling the fertilizer in with the grain?

Mr. HARRISON. No.

A member, speaking of smut, said he had stamped it out by using freshly slacked lime. He lays his seed-wheat on the barn floor, and sprinkles this lime on it. Those who drill cannot use this, however, as the grain swells and the iron would become corroded.

Mr. UPDEGRAFF was one of those who did not believe in drilling. This year he had best crop in his county—Jefferson County, Ohio.

Mr. DANIELS. What is the soil?

Mr. UPDEGRAFF. Limestone clay.

Dr. ELZEY. Did you use fertilizers?

Mr. UPDEGRAFF. Yes, sir; I have used it drilled in with the crop. I have planted out half the field drilled and the other half broadcast, and *vice versa*, always with an advantage in favor of the latter system. Perhaps at some time we will have a better and more rational plan of drilling, but to put all the seed in one little narrow streak is unphilosophical and wrong. If he were to raise a crop of wheat upon the success of which his life depended, he would broadcast it.

Mr. DODGE had made a statistical investigation some years ago relative to the comparative advantages of broadcasting and drilling. He had received returns from about a thousand counties, representing fully one-half of the entire wheat-growing field. In the Northwest, the spring wheat region, they favored broadcasting, while a very large proportion

of the planters in the winter-wheat region favored the drill. The tabulation of these returns showed the increase to be about 10 per cent. by drilling, the advantages stated being that the seed was placed more evenly and at proper distances, and less superficially, and in that respect had the advantage of prevention of winter killing.

Mr. BROWN, of Brown County, Indiana, had been experimenting with wheat for fifteen or twenty years, and has adopted a theory of a smaller quantity. Two years ago winter wheat was raised entirely, 15, 16, 18 bushels to the acre; two years ago he sowed one-half of the field in wheat, one-half bushel to the acre, and one-half at three pecks per acre, and the half bushel seeding yielded the most per acre. Practice in Eastern Indiana is to sow a bushel and a half to two bushels; with broadcast they find that it will freeze out, hence drilling is generally adopted.

Mr. FOSTER found that with black lands he could hardly broadcast at all, because of freezing out, and broadcasting has almost been abandoned. A bushel and a half to the acre is about the quantity. They are now experimenting to know whether a bushel or a bushel and a half is the better quantity. He sows a bushel and a peck.

Mr. PAGE had experimented, at the University of Virginia, with half a bushel, three pecks, bushel, and a bushel and a half. The best result was from a bushel and a half, next best, bushel, and so on, three pecks being better than one-half bushel. In regard to drilling, his land was poor, and he had found very little difference between the fertilizers sown broadcast and wheat broadcast, or fertilizers applied in same quantity with the drill, though he made rather more from wheat sown broadcast.

Dr. ELZEY stated that throughout Southwestern Virginia experiments had uniformly been in favor of the practice of drilling in the guano with the wheat.

Mr. JACKSON, of Tennessee, doubted whether the use of the drill paid; he had used the drill, but found it too slow. A colored man on a mule sowing broadcast keeps up with ten double plows, and when they close at night everything is up. With the other plan he had never been able to get a gain exceeding two bushels to the acre with a drill, hence he had discarded the drills because broadcasting was productive of better net results.

Mr. BEVERLY. May I ask how much you get to the acre with that sort of cultivation?

General JACKSON. From 20 to 25 bushels to the acre.

Colonel BEVERLY. How much seed?

General JACKSON. A bushel and a half broadcast as near as we can; it may run to a bushel and three pecks, our object being to make the most per hand, and not the most per acre. I will compare with any grain-drill in that section of the country as to the net results going into the pocket.

Professor HEDGES said in 1832 he was in Tennessee, near Batavia, when he met a farmer of great observation, who made more wheat than the rest of his neighbors. The secret was he always put on from one to two pecks more than his neighbors. His measure is a bushel and three pecks. He always selected his finest and largest seed. He would take his sack of wheat and sit on the head of a barrel and throw the wheat out with an oscillating motion, and you could see the seed fall pretty close together, but you would not see any oats fall with the wheat, for they were too light.

Mr. REYNOLDS said the general practice of the most intelligent

farmers is the best rule to observe in regard to these questions, and it is the practice of nine-tenths of the best farmers of Ohio, Illinois, and Indiana to use the same quantity of seed, and to drill it. Nine-tenths of the Dakota farmers broadcast it so as to keep the weeds from choking the wheat. With regard to the quantity of seed, nine-tenths of the farmers sow between a bushel and a bushel and a half. His recollection was, a bushel and three pecks, Clawson wheat, with one harrowing in the spring, yielded a total in four successive years of 205 bushels on one acre, and the quantity used was a bushel and three pecks to the acre.

Mr. AIKEN, of South Carolina, spoke at length upon the wheat growing of his section, and of the importance of being able to control the rust. He took issue with Professor Taylor relative to certain points, to which the professor replied.

Mr. WRIGHT, of the Indian Territory, asked General Jackson the kind of soil on which he sowed his wheat.

General JACKSON. Rather dark soil; black loam with clay subsoil.

Mr. WRIGHT advocated drilling, though he thought General Jackson was right for his locality. Temperature, climate, and latitude had much to do with it. To get rid of smut, he had advised his neighbors to put the wheat in brine that will carry an egg or potato. The foul seeds come to the top. In this brine he puts a little copperas, which kills the smut. The wheat, after being soaked in this brine, should be laid out on the floor and slacked lime sprinkled over it. The wheat is now coated with lime, and it must be put in the ground before it gets dry.

Mr. JACKSON. I would inquire of the gentleman from the Indian Territory, what would be the increased yield in a crop by subjecting it to this process over the ordinary method of fanning it?

Mr. WRIGHT. I should say it was nearly one-third, because better seed is sown.

Mr. JACKSON. It seems to me unless there is a very considerable increase in yield that it is a very troublesome experiment; in preparing seed for 200 acres, for instance. There seemed too great a degree of nicety.

Mr. WRIGHT. It is very easy to prepare the seed for whatever you require for each day's work.

Mr. BLOUNT. I would like to correct one thing. There are some who put smut and rust together. Smut attacks the head only. The rust appears on the leaf. The blasted head is caused by an insect which cuts the tap-root, as I have investigated and found to be the fact.

Professor TAYLOR referred to the importance of the preservation of seed, and his method of applying napthaline for destroying insects which infest it.

A MEMBER OF THE CONVENTION. I beg to state that the custom of fanning wheat, in order to prevent smut, is an old one, with which I have been familiar for forty years.

On motion of Colonel Beverly the convention at 4.45 p. m. adjourned.

MONDAY MORNING, *January* 16, 1882.

The convention was called to order at 11.20 a. m.

The president announced the receipt of the credentials of T. C. Johnson, of Gunnison City, also the receipt of a letter from the merino sheep

breeders, regretting that they had not time to select their delegates for the convention. The first address to be made this morning will be by Professor Hedges, upon the sugar industry of the United States. Following that will be an essay on the cereal capacity of the Indian Territory, by General Porter. The third paper will be the history and value of agricultural statistics, by Professor Blue, and the last, "National and international crop reports," by Mr. Chamberlain. Colonel Harrison will preside temporarily this morning.

The chairman *pro tempore* introduced Mr. Hedges to the convention.

Mr. HEDGES. I have been delegated to appear here this morning for the purpose of presenting, as well as I may be able, a subject the importance of which it is difficult to comprehend, and which I approach with a great deal of diffidence.

Though I left the farm earlier than most men, yet I have clung close to it up to the present hour, and no man has greater interest in the progress of agriculture than I.

There naturally came to me, on the early introduction of this cane into the country, a desire to know more about it, and the part it was destined to take in the development of our resources.

I read the reports of Governor Hammond, of South Carolina, in 1856, and became much interested therein. I had the pleasure of a correspondence with him, and in one of my letters I put the question to him, "Do you consider that this cane" (which was then the Chinese variety) "is to be a staple crop of this country?" His reply was, "I have no earthly doubt of it." Then to me, as a farmer, a mechanic, and a manufacturer, came the determination to help it forward as best I might. At first, like the miner in the mountains seeking for gold, I found traces of the precious metal. I found the "colored dirt," and now I have found the gem itself, the evidence of which you see before you [referring to samples], collected from a wide area of this country.

Owing to the agitation of this subject throughout the Mississippi Valley, and owing, moreover, to the drought that had attacked the sugar-cane of Louisiana, the planters of that section determined, some time since, to make the experiment of substituting sorghum for the cane, and, anxious to know the results of these experiments before the meeting of the Cane Growers' Association, I recently made a trip to Louisiana to gather all obtainable information upon the subject. I met the members of that association, and to them repeated the story of sorghum, and at my solicitation they sent delegates to the association, and if it please the convention to hear the report of the leading men who attended that body, I will have it read.

The secretary read as follows:

Mr. T. W. NICOL, of Louisiana, then read the following important communication:

Mr. PRESIDENT AND GENTLEMEN: Having engaged during the past summer to a small extent in the cultivation and manipulation of orange sorghum cane, I would respectfully ask the attention of the convention to some remarks and data on that now all-important subject.

In a great country like ours, where every article of food for mankind is produced, and where its agricultural products exceed that of any other country in the world, it would seem strange that sugar (which is consumed by everybody) has received so little of our attention as an agricultural industry. We, in Louisiana, in developing sugar growth, have had much to contend with, the principal things of which consisted in reclaiming our lands from overflow, and the introduction of machinery in manipulation. You, I apprehend, with your national reputation for enterprise and energy, have paid most attention to the propagation and production of the cereals, or staff of life, now controlling, as you do, the price of grain in the markets of the world. But, my friends, we Americans find that to make life comfortable we must have the "sweets" of life.

We all know the history of the introduction of the beet-root into European countries, the fostering care with which Germany, France, and Russia guided and gradually advanced sugar culture, until to-day those countries not only produce all their own sweets, but actually enter into competition with that great sugar country, the Indies. In the early colonial days of our country a premium was offered to those settlers who engaged in the production of grain. Well, as I said before, our capacity for grain production has assumed immense proportions, and we have never a fear in the future but that production will keep pace with increased population, and certain it is that a great nation will never suffer so long as food is plenty within her borders. But, gentlemen, let us examine the statistics and see if sugar is plenty. Surely, aye, positively not, when we produce only 12 per cent. of the quantity consumed. Then it were time to study the subject, and, if I know our people, if I am not wofully disappointed in the tremendous enterprise I have witnessed *en route* to your Queen City and in your country, I say, then, we are equal to the emergency; and if we declare that we are equal to the task, where is the remedy? Well, we are doing our best in Louisiana; we are fertilizing, building, improving, and husbanding. But our country has been a sugar-cane country, and when I say sugar-cane I mean that specimen brought many years back from the tropics, brought into our country almost accidentally, and when finally introduced here found, of course, to be an exotic, and surrounded by all the troubles of a new agricultural plant, the history of which I might dwell upon, but which is not the purpose here, for we have to deal with only stubborn facts and positive results.

Mr. Hedges and other gentlemen in this country have discovered another sugar-producing cane which, in the opinion of many in our section of country, bids fair in the near future to enter largely as an important factor in saccharine products.

During last summer and spring we found ourselves with small crops of stubble and indifferent stands of plant cane, and several of our planters bought of your orange cane, with a view to giving the mooted question a thorough investigation. The season was late and we were suffering with drought, and made a very poor stand all round, many not getting sufficient to pay a trial in the sugar house, but I persevered and finally got a good stand of cane on 1.81 acres of land, which I ground and manufactured into sirup with the following result, which was duly published in our county paper, and which I have brought along here. Owing to the fact that our refinery was disordered (having some improvements under way) we did not boil for gain, but satisfied ourselves as to the financial result of the trial. Just below us on the river, Mr. Williams, of Oakley plantation, Saint Gabriel Point, got a very nice sugar, which brought him 8¼ cents in the New Orleans market, being graded as good common second sugars. Captain Brown, of Anchorage plantation, Port Allen post-office, made a strictly prime second, or common off white. In neither instance did these gentlemen give me their tonnage, hence I cannot give as good an exhibit (owing to their bad stands) as some which follow. * * * It will be noted from the table that from one acre $30 net was realized, quite a handsome net revenue from a first trial. Now, on this same 1.81 acres of land I housed the heads and intend shortly to thrash out the seed, weigh it and pass it to the credit side of statement. Again let me say that from the first crop stubble there grew a luxuriant second crop, which, owing to the lateness of the season, I fed to our stock until frost killed it. I am satisfied from my experience that two crops of orange cane can be grown and manufactured into sugar or sirup.

Now, gentlemen, the sorghum interest is a new one to you, as well as to ourselves, and let me warn you, from the large experience which we have had in sugar cane, that you may not travel over the same ground we have, commit the same errors we have. A slight allusion to the management of a large sugar estate will best exemplify my meaning. Taking an estate comprising (in area) 1,300 acres in all and 900 in cultivation. We have in one building, central sugar factory, over $40,000 in machinery, leaving out cost of original plant and general plantation improvements. We keep these improvements insured constantly, but only use them 60 or 75 days out of 365. Now add to this interest on cost, wear and tear on machinery, and tax, and we have an annual expense of, say:

Interest on $40,000 for nine months	$2,400
Wear and tear lying idle, say 5 per cent	1,500
Annual improvements	500
	$4,400

Whether the buildings be small or large, the rule operates in proportion, and estimating the value of sugar houses in Louisiana at $10,000,000 we have an annual loss of say $1,300,000. As a strictly agricultural people this is radically wrong, and we are rapidly coming to the conclusion that a change must be made, and that change will be made in this wise: Large estates will be cultivated on the co-operative plan, they will be divided up into small holdings and the cane brought to mill and sold to the "central factory," and very soon, instead of having a sugar manufactory on each farm, we will have them only at intervals, covering such territory as the

capacity of the mills in their maximum will demand. This is the plan of the future and we will very soon have a home for thousands in sugar, whereas but lately these same lands were non-producing. When the beet culture was first inaugurated in France the farmer then borrowed his ideas from the Indies and fell into the same path that we have followed for three-quarters of a century. We all know the failures in France at the start, and we also know that it was through the intervention of the government, the expenditure of large sums of money in central factories that finally made the culture and manufacture of the beet a success there; so let us warn you—centralize your sorghum culture—put central factories where tons enough of the cane can be produced to justify the erection of machinery perfect and modern and of large capacity. I could extend this paper to volumes in giving items as to the manipulation of sorghum juice, but will say that the mode is absolutely similar to sugar cane juice, and in the near future we hope to become so identified with you as sugar growers that from time to time we can forward to you such data as you may require. In your new departure, on the very threshold of your industry, I say, adhere to the production of pure sirup and sugar. We give it to you as our experience that pure sugars can be made from sorghum and sugar cane without the introduction of deleterious chemicals. Avoid the insinuating speculator who would induce you to use them. We owe it to our posterity to produce health-giving food, and I offer it as a prediction that unless you do as we do in Louisiana, manufacture a pure, unadulterated sugar, your new-found industry will amount to nothing.

It is with feelings of gratefulness that we come here at your solicitation. We greet you as fellow-farmers of a common farming country, for, indeed it is true that the farmer in his noble calling is the solid rock of our country. We sincerely hope that in the near future sugar will not be solely a Louisiana crop. We are not a selfish people, and being assured that you are not, we look forward to the day when the sweets of life (sugar) shall be as much a product on the wintry banks of your great lakes as it is now in one narrow little country down South, where the sugar-cane has been known to blossom, teeming in richness of saccharine. Then, friends, let us hope that this new industry of yours will prove as great a success as it deserves, and that there will soon be as much sugar produced in our country as we consume. With thanks for your attention to my remarks I will close.

You will perceive at this day in the West there were many who doubted whether Louisiana would meet us half way. We had cheerfully extended the hand of fellowship, and we expected it in return from the farmers of that State, and hoped that this would result in the certain progress of this great industry. We only lack, gentlemen, such skill and steady, straightforward effort as will make this movement a success. We want no inflation; no exaggerated accounts; nothing of the kind, sir; we want to go to the bed rock. This industry will acquire prominence through the example of many of our Western men like Bozarth, of Cedar Falls, Iowa, Hon. Seth H. Kenny and S. A. Stout, of Kansas. Mr. Stout has been more recently in the business than the other gentlemen whose names I have mentioned. They all learned their business thoroughly, and made it a great success, and the result of their labors has been to lay by money every year.

Mr. Kenny, who is the vice-president of our agricultural association, said to me recently, "I have cleared about $3,000 this year." He started years ago with a little mill and worked up until he made $3,000. This year he is working up to two-thirds the capacity of his mill, and will probably lay by about $5,000, then he will be compelled to hold back, for I question whether he can get hold of enough cane immediately to extend his work much more.

Mr. Bozarth's sugar [indicating] is here. He sent us four barrels to Saint Louis. This was swung off by the centrifugal, as appears by the report I have. When this sugar was shown to the merchants on its arrival in Saint Louis, they said it was worth too much for them to buy it. If we were to buy that we should not refine it, but put it on the market. We buy coarser sugar than this for purposes of refinement. Mr. Bozarth was able to sell this sugar at 8½ cents, but Mr. Belcher said it will not find a market in the city, as all the buyers would like probably this or that [indicating coarser grades]. They would

not give what it was worth. Mr. Bozarth has this year added 100 acres.

It will be proper for me to make some reference to what I have heard at this convention. These are the kind of men I like to talk with—thorough, practical men, who are familiar with this question which we are considering.

Mr. Bozarth has a fine farm 5 miles from Cedar Falls. On this farm he produced his sorghum, and with the proceeds bought cattle. He said:

I accumulated money every year, and a few years ago I concluded I was making my money on cattle. I stopped the sorghum work and let it all drop; sold my apparatus and tried cattle alone. At the end of two years I had not made a dollar, and I went back to sorghum, and for two years I have cleared nearly $3,000 a year, putting up the works, and starting with 200 acres, and now have 400 acres of sugar, and my works are run by steam.

This increase in the extent of his production his experience qualifies him to make, and he will make it a success. Mr. Bozarth says that in all business, and it is a very singular expression, "If a man is to succeed, he must go after success as he would after a wife; he must fall in love with the girl, and hug to her through life." I say through the reports of this association that every farmer could do likewise and accumulate property by adhering to business and make it a success. Make it a first consideration in your efforts. In the morning think the first thing of your cane crop. The seed has been in the past too much a matter of secondary consideration. It has been kept out in the field. In Louisiana they waited to see if the stubble would not come up, and then waited till it was too late to plant the cane. You cannot plant too early, it is your money-making crop, and you must not wait until it is too late to plant. The experience of Mr. Stout is the same as that of Mr. Kenny. This is the type that is to be taken; select a man of experience in our business. Many men had larger crops than these farmers, but none so great a per cent. Look at Louisiana twenty years ago, and look at her now! What a difference I have observed between that time and the present. Inasmuch as I am the only representative of Louisiana here, I will say this: If Louisiana, with her present condition, had not the protection which the government affords, she would sink out of sight in a year.

I had a confidential conversation with one of Louisiana's first men recently, one of her largest capitalists, and he said to me, that from the upper sugar districts to the coast, that there was not one planter who could pay his debts if pushed. We are, he said, all poor; we had to rebuild our sugar establishments in Louisiana. The bankers of Louisiana loaned us the money to rebuild them. They could not be rebuilt on the old, cheap plan, but new factories had to be erected in accordance with the improvements of the day, at a heavy expense, so as to enable them to roll out the refined white sugar, suited to the demands of the time, and it is necessary that they should have this help in order to swing out from the centrifugal this Louisiana sugar from the cane. No other foreign element than the lime and the sulphur fumes are applied down there, and you see them throwing the sugar out in great snow-banks, with ten or a dozen men at work. They had to incur an enormous debt to get the machinery to do this. And now if they can be supported for a time, until liberated from this heavy debt, get their lands improved, and get the help they need from the North, they may be able to attain great success if you stand by them.

The CHAIRMAN. Is the sugar by that process bleached with sulphur fumes?

Mr. HEDGES. Yes, sir. There is no special method for treating sugar. They have been treating sugars these hundreds of years, and in all my reading I have found that there is but one straight-forward method to bleach the juice. They first pour it through a machine in which there are fumes of burning sulphur, which, on being passed through water, produces sulphurous acid, and in which the juice being thrown down into a spray is bleached, and the first step after that is to simply treat it with lime, boil it down, and nothing else. Of course, all juice from Louisiana is boiled down in the vacuum, which, you will all understand, takes off the pressure of the atmosphere and enables them to boil at a low temperature—temperature of about 140°, no hotter than our morning's coffee. The reason for this is that, should it be boiled at a high temperature, it is converted into what is known as "caramel."

Mr. GILHAM. Will the same process that the Louisiana planters employ for clarifying and whitening their sugar do for whitening the sugar of sorghum?

Mr. HEDGES. It will; if they can produce the same quality of cane, then the same process will produce the same results.

Mr. GILHAM. I shall ask two or three more questions before I get through, and before the points pass out of mind. What kind of soil, in your experience, is the best for producing this kind of cane?

Mr. HEDGES. My observation is that a calcareous soil, in which sand, loam, and clay are combined, or a sort of mixed soil. If you go into a bare, sandy soil it is probable that you may fail in some very dry seasons. The sandy soil of New Jersey, for instance, has produced good results. As regards fertilizers I will say that this crop is one of the most sensitive crops in the world where fertilizers are used. Some years ago I received canes, in sections of about six inches, from Utah, from an intelligent gentleman who used to act as correspondent of mine, and the juice of these samples was as saline as our hotel soups are. Of course it partook of this flavor from the soil in which it was grown; and it is a fact, which is well for us to understand, that in fertilizing, the greatest care should be observed, and here comes in the value of agricultural stations, to whose work I look as the salvation of our sweetness.

Mr. GILHAM. What would you consider the best methods of procedure to insure success to the common farmer?

Mr. HEDGES. I should advise the small farmer to attempt small works at first, and increase his works as success increases. His cane should be cut, at the proper time, and he should go forward steadily in that line, seeking the advice and studying the writings of those who have been successful.

Mr. GILHAM. I wish to ask you right there in regard to books. There is a great deal written in books that is not true, and what our common farmers want is facts. What do you consider the best quality of seeds, what are the several varieties, and what are the best for different soils in this country?

The CHAIRMAN *pro tempore*. If the gentleman will allow me, I think it might be better to let Mr. Hedges get through with his address, and then there will be an opportunity to ask him questions.

Mr. GILHAM. But it is important that we should take these points up as they occur and discuss them, otherwise we might neglect them, after the speaker has finished.

Mr. CHAIRMAN *pro tempore*. The gentleman must not misunder-

stand me; of course there can be no objection if Mr. Hedges is willing to be interrupted.

Mr. HEDGES. I have no particular boundary for my address; I wish to speak to the pleasure of the convention.

Mr. GILHAM. I feel that Mr. Hedges is a servant of the people, and I think I can safely say that he is willing to answer the questions of any gentleman present.

Mr. HEDGES. The question is quite germane to the inquiry, and in answering it I will say, with regard to the seed, that I have watched them closely, and that they have become as voluminous in names as it is possible to imagine, and my answer to inquiries of this nature is this: From my present view and knowledge of the subject I would plant but two varieties in all latitudes south of about Springfield, Ill., the Early Amber and Early Orange; I would plant them both for the reason that the Amber will give you earlier working, while the Orange will follow it and give you later working, and a larger crop ordinarily, for it produces one-third more to the acre, while it contains quite as much sugar. South of the mouth of the Ohio River the Orange will ripen early enough. The Amber cane is tender compared with the Orange, for two reasons, the first is that the shell of this cane is thin and is more susceptible to the sun's rays on this account, while the shell of the Orange is heavier, and is covered from joint to joint with a thicker coat, which protects it from these rays; and the same reasons might apply to the effects of frost, for it seems as though nature had intended it for a more southern climate, being a later cane, by furnishing it with this overcoat for the frosty nights.

Mr. A. C. BOYNTON, of Pine Hill, Tex., who made the best sugar from sorghum, and which polarized 97 per cent., found that his Amber cane suffered severely as soon as the weather became hot and dry.

The CHAIRMAN *pro tempore*. If the Chair comprehends the last question I do not think that Mr. Hedges has answered it exactly. We know that in Louisiana the principal profit is on sugar, and the molasses is incidental. Now, if sorghum was grown here would that be the case?

Mr. HEDGES. In New Jersey the people have so much faith that it will be the case that they recently contracted, I understand, for 1,200 acres of sorghum to be delivered next season.

The CHAIRMAN *pro tempore*. You have been telling us something about the manufactures in the West.

Mr. HEDGES. I have referred to Louisiana. So far as the West is concerned, I can state nothing beyond the reports that I have. The past season the works at Faribault, Minn., have made a large amount of sugar; this, however, was by the use of coal filters, a vacuum-pan, and centrifugal. I know of no particular instance among the mass of farmers where this industry has been taken up and pursued for a sugar product, but this is probably owing to the fact that their molasses sells so readily and at such a profit. I will, with the consent of the convention, read the report of a gentleman from Illinois, Professor Scoville, who has given considerable attention to this subject:

Mr. HEDGES read as follows:

Professor Scoville, of Illinois, read a paper on the subject of sorghum sugar, going into chemical and analytical details and processes of manufacture, in an interesting manner, giving as a result of the cultivation of one acre of cane the following:

600 pounds of sugar, at 8 cents per pound	$48 00
85 gallons of molasses, at 40 cents per gallon	34 00
Total	82 00

Expenses	$37 50
Net profit	45 50
Sale of glucose	20 00
Total profit	65 50

Mr. DANIELS. Where did that cane grow?

Mr. HEDGES. At Champaign, Ill. Professor Scoville has been working at this matter for two or three years, and you see that his net profit is $45.50, and then he has estimated the amount of glucose susceptible of being made from the seed at $20.

DELEGATE FROM MARYLAND. Right there may I ask you a question? I have seen a statement that on a Louisiana plantation a little over 3,000 acres produced in sugar and molasses over $100,000; more than was raised on the great Dalrymple wheat farm with seven times the amount of land. Have you any data by which we can get at the correctness of that?

Mr. HEDGES. I have not, sir. I have heard the same thing stated before, but I have never seen the report of the product of an acre of cane. There were other statements of net results besides that of Professor Scoville, though not carried out so carefully. The demand for sirups is constantly increasing, while the methods of making sugar in Louisiana and in sugar-houses of New York, Boston, Saint Louis, and in other sections of the country, are so improved that they do not make more than 40 per cent. of molasses thrown off as they used to do. They granulate to a high degree, and the molasses thrown off is not so good or pure, because the extra amount of sugar obtained detracts from the value and the quality of the sirup. I will now have read what Professor King said.

The secretary read as follows:

I propose to submit for your consideration a few sample tests and illustrations, as well as a few quotations from a reliable scientific report of an analysis of seventeen samples made for and reported to the board of health of the State of Michigan by Prof. R C. Kedzie. I make these few quotations from an extended article in the Louisiana Sugar Bowl, of December 22 (a paper largely devoted to the sugar interest). This full report should be carefully read by every person who considers their own health important.

No. 1. Pure cane-sugar sirup.

No. 2. Starch-sugar sirup. Contains some sulphate of iron (copperas), and contains in each gallon 107.25 grains of lime.

No. 3. The grocer called it "poor stuff." I have seldom seen an article that better sustained its recommendation. Made of starch sugar, contains plenty of copperas and 297 grains of lime in a gallon.

No. 4. Nearly pure cane sirup.

No. 5. Starch-sugar sirup. Contains copperas and 100 grains of lime in a gallon.

Nos. 6, 7, 8. All made of starch sugar. Contains sulphate of iron and plenty of lime.

No. 9. All the members of a family in Hudson, Mich., were made very sick by eating freely of this sirup. A starch-sugar sirup. Contains in the gallon 71.83 grains of free sulphuric acid, 28 grains of sulphate of iron, and 363 grains of lime.

No. 10. Contains starch sugar, copperas and lime; amount not estimated.

No. 11. A starch-sugar sirup. Contains in the gallon 141.9 grains free sulphuric acid, 25 grains sulphate of iron, and 724.83 grains of lime.

No. 12. Contains starch-sugar, seasoned with sulphate of iron and lime.

No. 13. Starch-sugar. Contains in the gallon 58.48 grains of sulphate of iron, 83.14 grains of free sulphuric acid, and 440.12 grains of lime.

No. 14. Starch-sugar. Contains in the gallon 80 grains of free sulphuric acid, 38 grains of iron, and 262.48 grains of lime.

Nos. 15, 16. Contain starch-sugar, sulphate of iron, and lime.

No. 17. Starch sugar, sulphate of iron, and 202.33 grains of lime.

A very important element in this discussion is the great disparity in sweetening power between cane sugar and starch sugar or glucose. One pound of cane sugar has the same sweetening power as two and a half pounds of glucose. In these starch-

sugar sirups the public is not only treated to compounds loaded with foreign and injurious materials, but they are enormously cheated in the very thing they seek to buy, viz., the sweetness. Sugars and sirups are bought not as articles of food solely, but entirely for their sweetness, and thus the buyer is largely defrauded out of the very thing for which alone he makes a purchase. The thought of using such mixtures as a relish for our food is not very appetizing. Some of these drips seem to be made up of about equal parts of fraud and dirt! A facetious friend has quoted in this connection the old saying, "A man must eat his peck of dirt before he dies." If any one feels uneasy lest he be defrauded of "his peck of dirt," let him eat a few gallons of No. 11, and he may rest on his laurels for the balance of his days.

My attention was called to the evil effects of these glucose sirups by a business friend in this city some four years ago; he said his children were feverish and restless at night, without appetite, and pale; he said he was using these drips, and that they had been eating freely of them; I suggested a change to sorghum, which he did and found immediate relief.

I am aware that some chemists will say that well-made glucose is not unhealthy because, they say, that nature in her processes of digestion transforms our starchy food into glucose before assimilation takes place; but will they claim that nature uses sulphuric acid and lime to do it?

The Early Orange seed which he planted produced a cane which did not turn red in the center where the Early Amber did. Let me say a little more in regard to the different varieties. I have just asked of the department for a list of the different varieties of cane which they intend to distribute, and, looking down the list, from a knowledge of all the names of all the varieties introduced by Mr. Rhey, the African and the Chinese variety called sorghum, I did not find but one single variety of either of these names, and that was Neeazana and Early Orange. The color of the juice and the seed is similar to the Orange, and, therefore, they call it the Early Orange. Then comes the Early Amber and the Gray Top and the Honey. The Honduras is a Neeazana, Liberian is another; White Liberian is another name applied to it, but there is no such cane. There is a Nesbit cane in variety, but Mr. Stumpson says, "It is hard to tell how it got the name."

A MEMBER (interrupting). Do I understand that they are names of one variety?

Mr. HEDGES. They are picked up. You can select the names you please.

A MEMBER. Are they all of one kind?

Mr. HEDGES. They are of the Chinese or African family. Rhey numbers fifteen varieties.

A MEMBER. When you select a variety which do you prefer?

Mr. HEDGES. I would buy Early Amber and Early Orange for our locality.

A MEMBER. Are they African or Chinese?

Mr. HEDGES. They are both members of the African variety. I do not think they have the same appearance as the Chinese. The latter has been almost abandoned. You see them once in a while.

Now, in the matter of the distribution, I hesitate to say anything which would look like instructing the department, but, at the same time, I have a letter which I will ask Mr. La Dow to read, after I have briefly alluded to it, referring to the distribution of seeds by this department. If I had all the varieties at once, I would not scatter them promiscuously all over the country. I would endeavor to acquire the knowledge which would enable me to send these various seeds to localities to which they were adapted. One locality is not sufficient. Here you could not develop that which in the Mississippi Valley would be most productive. I would send to the different establishments these different varieties, and let them report back. Then, if it prove success-

ful, it could be generally established; but if not and they did not suit the people, they could be rejected. Suppose it is announced by some speculator that he will furnish a new kind of seed at fifty or sixty cents a pound, a great many will at once respond, ordering the seed, and the multiplicity of names in the country renders this an easy matter. My advice would be to send these seeds out into the country to persons who will test them and report back. Then go forward and distribute to the masses, but not until then. Then you save the people from becoming the prey to speculators.

The following letter was then read:

SAINT LOUIS, *December* 29, 1881.

DEAR SIR: The facts concerning my little experiment with northern sugar-cane as food for live stock are as follows:

Early in May, 1881, I purchased of you ten bushels (600-weight) of sorghum seed, I think you called it Early Amber, and sowed it broadcast on old timothy sod, plowed under to a depth of about eight inches between the 15th of May and 20th of same month. From the time of planting until about the 8th of August, when I cut the crop, the rainfall in Saint Louis County was almost imperceptible. Notwithstanding the dry season the cane grew finely and maintained a rich green color. The crop was cut with an ordinary Wood's mower. Just after the cane tasseled, and after lying upon the ground for four or five days, I had it bound in large bundles and stacked it as I would have done with wheat or oats.

About the middle of November I hauled one stack into my barn and commenced feeding it to my stock, consisting of cows, horses, Shetland ponies, and sheep; they all ate it ravenously, and I have never seen them in better health or looking better at this season. My cows in milk and work horses are fed grain also, but the other stock have subsisted upon cane fodder alone since the middle of November. Prior to the middle of November I had been feeding corn fodder to my milch cows with two feeds of corn bran per day; upon substituting cane for fodder an increase of about 25 per cent. in my butter product was at once perceptible. I planted ten acres of corn for fodder about same time the cane-seed was planted and upon the same character of soil. The former grew only about three feet high and dwindled to about nothing under the combined efforts of drought and heat, when as has been heretofore said, the cane flourished and produced a large crop. Both cane and corn were sowed broadcast and covered with an ordinary farm harrow.

In repeating the experiment I should prefer to use a wheat drill, as I am satisfied the crop would be improved by this method. The cane came out of the stack in prime condition, and I observed no tendency to rot or mold. A friend of mine who made the test describes the stalk as tasting like sweet pickle.

I think I made a mistake in not sowing more seed to the acre, a little over one-half bushel being the amount I used, but even under this mistake I never saw land cleaner and better prepared to sow grass-seed than this was when the crop was removed.

I cannot, of course, say what would have been the result if the season had been wet instead of very dry. It is possible and probable that the process of curing would have been difficult and the percentage of loss in consequence greater, but my experience has satisfied me that for the purposes for which I use it, cane fodder is in every respect superior as food to Hungarian, German millet, or fodder corn.

Hoping that the foregoing will fully answer your inquiries,

I am, very truly yours,

THOS. T. TURNER.

ISAAC A. HEDGES, Esq.

Mr. HEDGES (continuing). The Honduras cane is the largest that has been brought here. It occurs to me at this moment that I have been told by some one who raised it, that it would take four or five months to ripen. It is an immense cane. I found some in Louisiana, and when I took it to some of the Louisiana planters, they doubted the propriety of using it, but for all that, I urged them to try it. They did not like it because it was too soft, but later in the season it got more of a solid stalk. These varieties can be well tried in the hands of the people. These are my views on that subject.

Mr. Bozarth was the treasurer of our association. I employed a sten-

ographer to take down the proceedings of our convention, and I presume it is now published in pamphlet form; and our treasurer took the responsibility of publishing and distributing it, calculating to sell it for what it cost. Mr. Bozarth is fully reported in that book. He claims to have made from 140 to 200 gallons of sirup to the acre. It can go much higher in a favorable season. It has been in such great demand and the supply at hand has been so small, that he can sell it readily for 45 cents a gallon, and could have got 50 cents. Nevertheless, he found that one-third of all the sirup boiled would granulate in spite of all his efforts to prevent it.

Mr. DAVIS. Is there more money made in making sugar or sirup?

Mr. HEDGES. We will leave the Mississippi Valley for the present. We learn from the report of Mr. Cook, that Mr. Hilgard has for some years been making large profits. He says that he went to Mr. Hilgard's of New Jersey, to get a report of the result of the conduct of his sugar works. Mr. Hilgard said, "I have no report to make." "Well," Mr. Cook replied, "I am going to the convention of Saint Louis, and they have requested me to procure what information I can about the matter." "I have none to make," he replied.

A MEMBER. Who was at Hilgard's place, who wanted a report from him?

Mr. HEDGES. The New Jersey Agricultural Association had offered a premium, and Hilgard was contending for it, but he would make no report. He had made some 2,000 tons of sugar and has about 1,200 acres of land in cultivation right around his works. He said that he found it necessary to control the supply of cane, and sometimes he could not get enough. He said that he had bought this to make a supply on. This I give as an illustration, showing which way the wind blows. Here is a man with a plantation of 1,200 acres, equal to the best plantation in Louisiana.

I will say that when men talk to me about making a first-class sugar by chemical process, and compare it with nature's process, it is like a man making medicated whisky.

I do not know that I have any other question to speak of. I have probably kept the floor as long as I ought.

The CHAIRMAN. It is a very interesting question.

Mr. HEDGES. There is a report of H. W. Wiley, which comes from Indiana. I will read that as it will throw additional light on this subject. He tells the true story of the condition:

To secure a good article of sugar for consumption is a matter of no little importance to the American public. So great has become the consumption of this article that a variation of only a small per cent. of saccharine matter involves annually millions of dollars. Consumers should insist on knowing from dealers the character of the sugar which they purchase. First of all, it must be granted that the sugar which is most valuable to the consumer is the crystallizable cane sugar, whether it be derived from cane, the sugar beet, or the maple tree.

To detect the amount of such sugar no other means can compare with the polariscope. Pure cane sugar has the power of rotating the plane of polarized light 66.7 to the sight. All other sugars act on polarized light, but in different degrees. Happily we can detect the exact amount of cane sugar in a mixture of any number of sugars whatever. I will not undertake to describe this process, which is of interest only to the practical chemist. I will only say that the polariscope carelessly used may give rise to the most alarming errors, while on the other hand its judicious use will lead to results which are entirely trustworthy. In the sugars which I have examined I have found only three impurities which need to be brought prominently to the notice of the sugar-makers and the sugar-eater.

First. *Water.* Water is certainly a harmless ingredient; nevertheless we object to paying 8 cents a pound for it. Many low grade sugars will be found to contain fully 10 per cent. moisture; while on the other hand first-class refined sugars will have less

than ½ per cent. Obviously in buying sugar it is of great importance to determine the amount of water which they contain.

Second. The next ingredient which is of importance commercially is invert sugar. This is only found in low-grade sugars, and is not present in white refined sugars in quantities sufficient to impair its qualities. This sugar arises by conversion of cane sugar by high temperature or prolonged boiling, or by the action of the acids natural to cane juice. Invert sugar is the chief ingredient of molasses, aside from the uncrystallizable sugar originally in the cane.

Third. The next ingredient which I shall mention, and the one greatest in commercial importance, is starch sugar, or amylore, which is mixed with cane sugar to increase profits of sales. I have examined a great many of these mixed sugars and have found the per cent. of starch sugar varying from 20 to 50 per cent. The starch sugar, when well made, in my opinion, contains no deleterious ingredients, and the only objection to its use is found in the fraud which the mixing perpetrates on the community. Starch sugar is now made as white as the finest refined cane sugar, and is capable of being reduced to a fine powder suitable for mixing. To the unpracticed eye these sugars readily pass for the genuine article and thus readily find their way into the trade. The quantities of these mixed sugars are great, and from the data I have been able to collect I place the total amount at not less than 2,000 barrels a day.

To detect any or all of these adulterations the polariscope is almost a necessity, and consumers would do well to demand of dealers some guaranty of the purity of the goods they purchase.

If there is no other question, I will simply close by saying that the erection of works on a large scale ought generally to be confined to stock companies. For, in the present stage of this business, if the uncertainties and danger of loss are to fall on the shoulders of an individual during the first year of an industry it would be beyond their capacity to sustain the loss; and while gentlemen may each put in a little, many could not stand under such a misfortune alone. I understand that not many of those engaged in this industry have met with favorable results, such as paying dividends, &c. They are, however, encouraged, while the season has been one of the most severe ever known. The grasshoppers have never cut it, and the chinch pays no attention to it. Its foes are late planting, and in the form of heavy rains. The men to whom I have referred are determined to go forward. There is no intention on their part of faltering or deserting this industry, and the people of the Mississippi Valley will never abandon it. They will carry it on and make it a success. I thank you for your kind attention.

The CHAIRMAN *pro tempore*. But a few minutes remain before the time will arrive for adjournment. There is not time for the reading of another paper. The chair will suggest that any questions which will bring out matters of interest touching this subject may be asked by any of the members and the public, and with the concurrence of the committee, will suggest, inasmuch as another committee has also been appointed, whose duties have been somewhat similar, that we hear from that committee now.

Mr. GILLHAM. We have occupied some time on this sugar question, and our time is growing short. The committee that was appointed on pleuro-pneumonia is ready, and would like to report if it be the will of the chair and convention to hear it.

Dr. ELZEY. The proposition the gentleman has just made should be adopted, and we should occupy the remaining time of the morning hour in receiving the reports of the committees. There are two, I think, of one of which I am chairman. We have had the matter in hand for several days, and it should now be disposed of, while the discussion on sorghum can go over until after the recess. I therefore move that the convention now dispose of the reports.

The motion was agreed to.

Dr. ELZEY. I was appointed chairman of the committee raised for

the purpose of presenting the subject of pleuro-pneumonia among cattle to the consideration of Congress.

Mr. GILLHAM. The committee appointed by the convention to secure all bills presented to the last Congress relative to this subject, and to examine into the methods of their workings, is now ready to report, and Dr. Law will read the report.

The CHAIRMAN *pro tempore*. Is there objection to the consideration of this report? (After a pause.) The chair hears none, and the secretary will read.

Professor Law read the following report:

REPORT OF COMMITTEE ON LUNG PLAGUE.

Your committee, appointed to secure all bills offered in the last and present Congress treating on the subject of the extinction of the contagious pleuro-pneumonia of cattle, with the view of recommending legislation, beg leave to report that they have had them under consideration, and herewith present them, together with the recommendations below. In the various bills we have found provisions for other objects than the extinction of contagious pleuro-pneumonia, and believing, as we do, that the special urgency of this case demands speedy and specific action, we recommend the passage of a single act for this exclusive purpose.

This we advocate in view of the existing yearly losses of millions of dollars by the contagious pleuro-pneumonia, or lung plague; of the steadily increasing danger of the extension of this disease to the open grazing grounds of the West and South, with the certain increase of the losses to tens or hundreds of millions; and of the certainty with which this plague, exotic to our land, can be early stamped out and permanently excluded from the United States, which cannot be said with equal confidence of any of our other existing animal plagues.

The extinction of the existing germ would be the extinction of the disease for all time on this continent, unless reimported.

2d. While heartily approving of Federal legislation upon other contagious diseases of animals, for investigation, experiment, exclusion, limitation, or extinction, as well as for statistics on animal industries, yet we are unanimously agreed in the opinion that no such object should be provided for in the same act with lung plague, nor should any money appropriated for lung plague be made available for any other such purpose.

3d. That in view of the terrible losses that would accrue from the extension of this lung plague, we are of opinion that such extension should be provided against by the prohibition of the movement of any neat cattle out of an infected State into any other State or Territory, or the District of Columbia, excepting under a quarantine of three months, to be controlled by a veterinary sanitary organization designated by Congress. This we consider the first duty of Congress in this matter, being a measure of protection which is an essential prerequisite to all effective measures for stamping out the plague, and one which cannot be constitutionally applied by the States, but must be done by the Federal Government in accordance with the clause that Congress alone can regulate inter-State commerce.

4th. That in the matter of the extinction of the lung plague in the different infected States and in the District of Columbia, we recognize the difficulties that attend the construction of a statute which shall enable the Federal Government to operate effectively within the individual States for this purpose, and if the wisdom of Congress cannot devise an effective measure of this kind, we would strongly advocate that a sufficient appropriation should be made out of the Federal Treasury to meet the greater part of the outlay of the different States in carrying on this work; such money to be disbursed by some designated officer of the Federal Government, on the approval, by the above-named veterinary sanitary organization, of the method and execution of the work conducted by the State authorities for the extinction of this plague.

5th. In advocating such an appropriation we would represent that the infected States are not liable to be so seriously injured by the extension of this plague as are the States as yet uninfected, so that it is even more for the interests of the latter than for the infected ones to have the disease speedily *stamped out;* also, that, according to the best authorities, two million dollars judiciously applied would more than suffice for the complete extinction of this lung plague of cattle, while we are now, in consequence of its existence, losing considerably more than two million dollars yearly on our exports of cattle to Great Britain alone; and as these cattle for export are mainly furnished by the West, this loss is almost exclusively a Western one.

The most essential measures for *stamping out* the disease in infected districts are the following:

1. To prohibit all movement of cattle, except by special permit.
2. To prohibit the pasturage of two or more herds in one inclosure, except under special permit.
3. To prohibit the pasturage or exposure of cattle on highways or on any other place not securely fenced.
4. To prohibit the turning of infected or suspected cattle into pastures adjoining a highway or other pastures occupied by cattle.
5. To establish, in the ports of New York, Philadelphia, and Baltimore, bonded markets for the reception of cattle from uninfected States for distribution and export.
6. To secure, under proper veterinary supervision, the prompt destruction of all cattle suffering from or infected with lung plague—acute or chronic—and the disinfection of all yards, buildings, cars, boats, places, and articles that have been exposed to contagion.
7. To provide a liberal indemnity for all cattle, promptly killed under condemnation of the official veterinarians for the purpose of stamping out the plague.
8. To provide suitable penalties for failures to report the existence of the disease, and for any other transgression of the rules made under this law.

D. B. GILLHAM.
JAMES LAW.
HENRY C. MEREDITH.

Accompanying this report were sundry bills introduced into the last Congress, as follows: House bills Nos. 6871, 6925, 1351, 6513; Senate bills Nos. 1473, 1893, 2097, 1908.

The CHAIRMAN *pro tempore*. It seems to the chair, that in order for the convention to act intelligently on these resolutions, some enlightenment might be advisable. For instance, not being an expert in cattle, I, for one, do not know whether this lung plague is identical with pleuro-pneumonia.

Dr. ELZEY. They are identical. They are two names for the one disease.

The CHAIRMAN *pro tempore*. Then, is there any reason why they should not go out as the sentiment of this convention?

Dr. ELZEY. My resolution is simply such as would make it appear as a preamble for these resolutions. At first we thought of merging them into one, as my resolution was what might be styled a "glittering generality;" and then we thought it might be introductory to them. And I now move the adoption of the report read by Professor Law, and that a copy of it be transmitted to Congress.

The motion was agreed to.

The CHAIRMAN *pro tempore*. The time has arrived for the usual recess.

Mr. DANIELS. It is understood that the sugar discussion takes precedence this afternoon?

The CHAIRMAN *pro tempore*. I presume so, if it be the pleasure of the convention.

The convention at 1.08 p. m. took a recess until 2 o'clock.

The convention reconvened at 2.23.

THE PRESIDENT. The remaining papers for this day's consideration are, first, "The cereal capacity of the Indian Territory," which General Porter was requested to present at the opening of the afternoon session to-day; the "National and international crop reports," which has been assigned to this afternoon; and "The history and value of agricultural statistics."

The Chair will now be very glad to listen to General Porter.

Mr. DANIELS. Allow me, Mr. Chairman, to say that the matter of sugar was under discussion, and I believe it was the sense of the convention that that discussion should be continued.

The PRESIDENT. The Chair will suggest that one morning occupied with one subject ought to be a fair allowance in such a convention as this. The Chair has no desire in the matter further than that we should consider the wants and rights of other gentlemen. The whole matter is in the hands of the convention. I merely announce the assignment.

Mr. PORTER. It would be very difficult for me to present anything in reference to the subject that has been assigned me that would be of practical value. I can present no accurate data as to the cereal capacity of the Indian Territory, but, for the information of the convention, I will ask Mr. Dodge to read the statistics of 1880 of the grains grown and stock then in the Territory owned by the Chickasaw, Choctaw, Cherokee, Creek, and Seminole tribes.

Mr. DODGE. This statement is made up from some official figures on record in the Indian Office in this city.

The following is the table read by Mr. Dodge:

	Chickasaw.	Cherokee.	Choctaw.	Creek.	Seminole.
Population	6,000	19,720	15,800	15,000	2,667
Acres tillable	2,500,000	1,600,000	3,000,000	2,300,000	70,000
Acres in reserve	5,031,351	3,215,495	6,688,000	4,650,935	200,000
Acres cultivated in 1880	92,398	65,000	100,000	40,000	17,000
Acres broken in 1880	.....	2,500	5,500	5,000	.....
Bushels of wheat	58,424	78,000	200,000	.....	.....
Bushels of corn	726,042	200,000	1,200,000	.....	220,000
Bushels of oats and barley	52,568	20,000	50,000	.....	2,000
Bushels of vegetables	190,000	150,000	150,000	80,000	25,000
Tons of hay	70,000	22,000	20,000	12,000	1,500
Horses	13,512	18,000	17,441	10,000	2,500
Mules	1,239	1,300	999	1,500	100
Cattle	66,746	100,000	48,294	77,000	5,000
Swine	107,721	50,000	138,561	100,000	4,000
Sheep	14,442	7,500	9,792	2,000	200

Mr. PORTER. You will observe that these statistics cover only the five tribes of the Indian Territory, known as the civilized tribes. Aside from the tribes here mentioned, there are some twenty-eight or thirty small Indian tribes that have been located in the western part of that Territory by the government, where they are now being taught agricultural industries. I am unable to furnish statistics relative to what is being done there. Now, in regard to the Indian Territory, it will be remembered that that part of the public domain was set apart by the United States Government, under the act of Congress passed in 1830, for the occupation of the Indians, and the President was authorized to locate Indian tribes in that country, removing them from States further east, and giving them such areas in the Territory as would be sufficient to give them sustenance. Then it was understood, as remarked a few days ago, that that whole country was a desert, and in setting it apart for Indian occupation I remember that the government believed that it was a country peculiarly adapted to the Indians, a country abounding in game, but unfit for agricultural purposes, and hence beyond the limit of civilization, and beyond what civilized man would ever want.

The Territory has proven to be a country that can be made useful for other purposes, and from time to time portions of that country, originally set apart for Indians, have been carved out and States have been made from them—Nebraska, Kansas, and other Northwestern States. Now, what I wish to say will be in regard to that part which is still known as the Indian Territory, and which is located between Kansas on the north, Texas on the south, Arkansas and Missouri on the east, and Texas partially on the west. Formerly the productive

capacity of that country has been found to have been very much underrated, but in latter years my impression is that it has been very much overrated. We raise in that country corn, wheat, oats, barley, potatoes, and in fact all the vegetables that are raised in Kansas and Missouri, and in addition we find that the raising of cattle and of horses could be made most productive of wealth to our people. Over our country grows grass that feeds the stock without cutting it, and the beef that we raise in that country yields us greater profit than any grain we ever attempted to grow. Corn has not been raised to any great extent from the fact that there has been no demand for it except for home consumption, and the five civilized tribes have always raised more than home consumption demanded, unless drought caused a failure, and enough to furnish the bordering community from north to south, from Texas to Missouri and Kansas to Texas.

I have lived in that country for forty years, during which time I have made some observations; having been brought up on a farm, and having traveled all over the country I have reached some very positive conclusions with regard to its capacity, and what it was by nature ordained to do. In the first place, while the land along the river bottoms is very rich, and capable of producing a great deal of grain, a greater portion of the country, which is the high prairie country, is dry and produces grass only: whenever it is broken up for a few years it produces grain pretty well, but on account of the winds, which sweep from the Missouri to the south, which occur generally in the spring and fall, and which continue for thirty-six to forty-eight and seventy-two hours, the soil being of a light texture blows away, and in five or six years its productive capacity begins to fail, and shortly afterward that which remains is gravelly and sandy. The older fields that we have will produce nothing. Now, that same soil when left to grow the grass which nature has planted will produce more value in beef and cattle to each acre than can be produced from any variety of grain.

It has occurred to me, from a careful observation, that a great part of this Territory was never intended for an agricultural country, and can be made so only by planting trees that shall protect it from these driving winds. Like all prairie countries the Indian Territory is covered with innumerable little hummocks, or you may say something resembling pock-marks on the surface of the prairie. These are caused by little animals burrowing into the soil and bringing it out in the process, and then during the hot periods, when the ground becomes very dry, these driving winds carry before them all the soil they catch at these places. The heavier soil remains, but this, without being mixed with other soil, produces scarcely anything. At one time I observed a fact which may not, however, be of any value. Some years ago the grasshoppers from the Missouri prairies came down in that country making their camping ground on these sandy fields. They went into the fields and destroyed the wheat in the fall, laid their eggs in the fall, and in the spring destroyed everything that was planted. The result was that the following year grasses that had never grown in that country came up on those lands where they camped. These included the western grasses that grow along the mountains, and the buffalo-grass.

Again, in 1868, they besieged us, sweeping over all the prairie country, and wherever they went these grasses are coming up in little bunches. This incident suggests to me that that country is better adapted to grazing than to other purposes, and that these grasshoppers were the means provided to introduce these heavy grasses in the place of the lighter ones, and which are destined to protect the soil from being

blown away. While this country may eventually be made a fine cereal growing country, I think it would be much better if stock were made the principal industry of that country at present, and after awhile the tramping of stock over the country, and the growth of trees, may help to make the production of cereals its chief and most profitable industry.

Mr. WELLS, of Ohio, on behalf of the President, extended to the National Agricultural Association an invitation to meet the President in the evening, and the following resolution was unanimously agreed to:

Resolved, That this National Agricultural Convention accept the courteous invitation of President Arthur, and that we pay him our respects by calling at the White House at 9.30 this evening.

Dr. LORING. Is there any further consideration of the question?

Mr. WRIGHT, of Indian Territory, hoped that not only the cereals but also cotton would be remembered. This has been raised more especially by the Choctaws on the Red and Arkansas Rivers. Those people have raised most of the cotton on bottom lands. It is a useful production, and is carried on by quite a number of those who were born there. We have no farming business on a large scale. Cotton raising is entirely confined to the eastern part of the Territory, and the western part is better adapted to the raising of stock. In the Choctaw country there grows what is called mesquite, and you will find the plains covered with cattle. In that part of the country, near the line of the railroad, cattle are successfully raised, though few are exported. There is an abundance of grass on these plains especially adapted for stock. It does not equal the blue grass of Kentucky, of course, but is an excellent grass for feeding stock, and you may go where you will and find plenty of it. Our stock is very well fed.

Mr. HEDGES suggested the use, as the forage of the country, of cane and sorghum. A letter from Colorado, where the cane was planted, and where there was no rain from the time it was put in the ground until the last of July, showed that they made a good large forage crop of this plant. It attained a height of about five or six feet, and being planted early it withstood the driving winds. It could be put in in the fall. We have been very successful planting it in the fall. It will come up in the spring, and I am confident that more can be grown to the acre than if it were planted in corn. Then after this is grown and cut it can be sowed again, and give them a cereal crop at the rate of 25 or 30 or more bushels per acre.

Mr. FOSTER. I move that we proceed to the reading of the next essay. Adopted.

The CHAIRMAN. The next paper is on national and international crop reports.

NATIONAL AND INTERNATIONAL CROP REPORTS.

BY W. J. CHAMBERLAIN,

Secretary of Ohio State Board of Agriculture, Columbus, Ohio.

Mr. CHAIRMAN. I need not, in this presence, argue at any length to show the importance and value of prompt and reliable crop statistics. It is now pretty generally conceded that an accurate knowledge of the present condition of the crops month by month is the only legitimate basis of prices and of trade. It is also coming to be conceded that the Agricultural Departments of State and nation are bound to furnish such information *to the people month by month* in the interests of business, commerce, and agriculture, and to see to it that the information is accurate and impartial; that is neither in the interests of "bulls" nor of "bears," but of truth.

Heavy speculators obtain this information more or less accurately for themselves, and

at great expense. If the mass of producers and consumers are to have similar information in the interests of justice, truth, and fair and equitable prices, then State or national agencies must furnish it; and this I believe can only be done by concerted action, by a full and cordial co-operation of State boards with the national Department of Agriculture.

With a view to securing this harmonious action, as well as more full action in the several States, an "inter-State" convention of State boards of agriculture was held in Springfiled, November 30, to December 2, 1880. The proceedings, papers, and discussions of that convention were widely published in the Western daily and agricultural papers, and in full in pamphlet form for distribution, and had great influence on the legislatures and boards of agriculture at the West, some five or six having decided to issue crop reports.

The present National Convention, called by Commissioner Loring, was most clearly foreshadowed and urged in several of the papers, discussions, and resolutions of that convention. One entire paper, suggested by the committee that called that convention, and prepared by Dr. R. T. Brown, of Indianapolis, formerly chemist of this department, was on "The relations of State boards of agriculture to the National Department." From this paper I quote briefly:

"The several State authorities come in contact with the agricultural interest at two points, two wit: the agricultural colleges and the State boards of agriculture.

The misfortune that paralyzes the active usefulness of both these institutions is, that while they maintain only an indirect relation to the State, they have no relation to each other, nor to the department at Washington. The result is that neither realizes the usefulness it is capable of."

And again Dr. Brown says:

"We have at Washington what was intended to be the head of a great agricultural organization embracing all the States and Terrritories, but it remains merely a head, with no limbs or body through which to act. In nearly all the States we have boards of agriculture, organized by State legislation, and acting within their own jurisdiction, entirely independent of each other. I think the present convention is the first attempt to obtain concert of action, in any degree, among the State boards. The initiative of this action should have been taken by the department at Washington years ago—not, indeed, in the spirit of dictation, but by way of invitation for mutual counsel and advice, to the end that such relations might be established as would bring all the State boards into direct communication with the department, and through it, with one another."

Thus clearly and exactly was this present convention foreshadowed and its need felt; and it is simply one proof of the wisdom of our present able Commissioner that he made it one of his first official acts of any leading importance, to call just such a convention to bind together the many weak and disconnected threads of individual and State aid into one strong cord of unified national action and valuable result. I call your attention to some of the resolutions of that first convention:

"1st. That we believe the time has fully arrived when each of the States represented by us should undertake the work of issuing prompt and accurate monthly crop and stock reports during the growing season.

"2d. That in our opinion uniform and concerted action among these States in this matter will secure results most valuable to the agricultural and business interests of the country.

* * * * * * *

"4th. That in order to determine the fair market value of the annual grain and live stock products of the United States, it is necessary to obtain the earliest and most complete information attainable as to the extent of the foreign supply of grain and live stock, and the surplus for the markets of the world, and the proper officers of the government are therefore earnestly requested to obtain, through the consular and other foreign service of the United States, the most complete possible data concerning the extent of the annual production of grain grown in foreign countries, and the condition of the growing crops as the season advances.

"5th. That the information so obtained be given to the Associated Press, and be forwarded through the national Department of Agriculture to the several State boards of agriculture at the earliest practicable date after receipt.

"6th. That the several State boards of agriculture collecting live-stock and crop statistics are requested to reciprocate and forward such reports to the national Department of Agriculture as promptly as possible.

* * * * * * *

"9th. That all the grain and meat-producing States of the West and South be cordially invited to unite with us in our next meeting to be held next year at the call of our executive committee."

Before the executive committee referred to above had named the time and place for the second inter-State convention Commissioner Loring had, with broad and liberal views, issued the call for the present National Convention. The executive committee,

therefore, were in doubt for a time what was wisest to be done; but finally decided to issue a call for the inter-State convention to meet at Chicago at the time of the Fat Stock Show, partly with a view of indorsing this call of Commissioner Loring, and appointing special delegates to attend this National Convention, and of urging all our boards to respond cordially to this call. The discussions and full interchange of views in that convention resulted in a series of resolutions unanimously adopted. The first three acknowledge the necessity of and demand for prompt and accurate monthly crop reports in each State; recommend uniformity of action; offer a detailed plan for collecting these statistics in the several States, and pledge the hearty co-operation of the boards there represented. The remaining resolutions I give in full.

"4. That the prompt consolidation and publication of these monthly reports from different States can be best accomplished through the national Department of Agriculture, and we recommend that all important final footings in each State be telegraphed to the Commissioner at Washington, not later than the 8th day of each month of the growing and harvesting season.

"5. That an executive committee of nine be appointed to attend the national convention called by Dr. Loring, United States Commissioner of Agriculture, and to be held in Washington the second week in January, 1882, and that said committee be authorized, in consultation with Commissioner Loring, to arrange all details necessary to harmonize the work of the State and national departments, and render it more efficient; and, especially, to prepare blanks to be used in common by all States in this monthly statistical work.

"6. That in order to determine the fair market value of the annual grain and meat products of the United States, it is necessary to obtain information as prompt and as reliable as possible, month by month, as to the condition and prospects of the foreign grain and meat product, and consequent probable demand for our surplus, and that, therefore, we urge our most able United States Commissioner of Agriculture to obtain such information through our consular and other foreign service (through courtesy of the Department of State), and publish it promptly through the associated press, and send it by telegraph to the secretaries of all State boards that furnish like information from their own States to the United States department.

"7. That we urge each State to use every effort to perfect its own system of monthly reports, making it so prompt, thorough, and accurate that the United States department shall not be compelled to go over the ground with a separate corps of correspondents; but being relieved of this drudgery of detail, shall have the more time and force for other important work in the interest of agriculture.

"8. That we are gratified to notice the call referred to above as made by Commissioner Loring to a national convention in the interests of agriculture, and urge upon all who are officially in charge of the agricultural interests of the different States to respond to that call, and make that convention beneficent in its results."

The resolutions were unanimously adopted, and the executive committee mentioned in resolution 5 was appointed, and is now in attendance here.

I have given the resolutions of these inter-State conventions thus fully to show that the West is ripe for and demands this statistical work. And I am sure our State and national departments of agriculture can in no other way, at so small an expense, confer so great benefits upon the farmers of the land as by furnishing this kind of information.

Our papers and discussions for these two days on our cereal products naturally divide themselves into two classes: first, those that relate to production, and second, those that relate to distribution, sale, and consumption. But the questions how we shall increase the amount and diminish the cost of production, are not more important than those that ask how we shall *obtain just prices for our products*. And while the *farmers themselves* can largely solve the first class of questions—can buy or propagate new and improved seeds, conduct experiments, study methods, processes, fertilizers, breeds, breeding, and the like *without aid* from State or national departments—yet it is impossible for them to gain a correct knowledge of the probable supply of and demand for the grain product of the world *except* through State and national aid. Heavy speculators, indeed, can and do get and use such information as I have said, but the individual farmer cannot. And I need not argue in this presence to prove that it is or the promotion not only of our agricultural interests, but of the general interests of business that both producer and consumer should know the real condition and probabilities of the crops as the basis of an equitable adjustment of prices. For if the heavy speculators alone know the condition of the crops, they can "bear" the markets until the crop is bought at too low a figure for the facts, and so defraud producers, and then "bull" the market until they have unloaded at too high a figure for the facts, and so defraud consumers. And it is plain that the interests of agriculture are best promoted and future production is most stimulated and increased when *the farmers really get the fair price* for their products and the dealers simply get the fair compensation for the risk and cost and skill of handling the product.

For example, if the 100,000,000 bushels of wheat produced annually by the two States

of Ohio and Illinois is through the farmer's ignorance of facts sold at $1 per bushel when the real facts of demand and supply and the tendency of prices justify $1.25, then the 25 cents per bushel or the $25,000,000 goes largely *into the hands of speculators* to enrich them and become dead capital or to be expended in our cities on mere luxuries that shall, in no way, increase the fixed and *productive* capital of agriculture. But if the *farmers* get this $25,000,000 it goes largely into better buildings, implements, stock, fertilizers, books, papers, and real agricultural education that *shall assuredly increase the total future products of the soil.* In short this vast sum is then turned into real *productive capital*, into agricultnral prosperity, that shall also increase our *commercial and national* prosperity for years to come.

Consider now for a moment our foreign grain demand, its magnitude and its vast increase. Our total wheat export for the fifteen years preceding and including 1877 averaged in round numbers 46,000,000 bushels annually. Since then it has averaged 170,000,000 bushels annually or nearly *four times as much* in total bushels. For the fifteen years our total export was 18 per cent. of our total product. Since then it has averaged 37 per cent. or, to repeat, our *per cent.* of export has *doubled* and our total export has almost quadrupled.

A simple table shows this clearly to the eye:

Bushels of average annual export for fifteen years up to 1877 =	46,000,000
Bushels of average annual export for three years since 1877 =	170,000,000
Per cent. of export to total crop for fifteen years up to 1877 =	18
Per cent. of export to total crop for three years since 1877=	37

If, then, we consider the single fact that we are now annually exporting *more than one-third of our entire annual wheat crop*, it will at once be seen that it will not do to neglect this foreign demand as a factor in estimating or prognosticating the *tendency of prices*, or, in other words, the legitimate and probable price of wheat. Especially evident does this become when we remember the additional fact that this foreign demand is *exceedingly variable.*

Compare the exports of two pairs of years:

In 1877 the export was, in round numbers	54,000,000
In 1879 the export was, in round numbers	146,000,000

Or nearly three times as great. Again:

In 1878 the export was	89,000,000
In 1880 the export was	178,000,000

Or just twice as great. The increase was largely due to disastrous failures in foreign crops, and these failures might have occurred alternate years instead of in succession, *i. e.*, two good crops and then two poor crops.

And yet, notwithstanding this vast and exceedingly variable export demand, the astounding fact meets us that up to the present time we have had *absolutely no official means* of ascertaining and publishing to our producers and consumers the *real condition* of the European and Asiatic crops. And so, as a people we have "sat in darkness and the shadow of *financianl* death," until a few heavy dealers and speculators who could afford to *pay for and conceal* this knowledge that the government should give to the people, have swept the board and taken the profits that should have gone largely to the producers. For our heavy grain speculators know the value of such knowledge and have combinations with one another by means of which they get it promptly and with approximate correctness. With branch houses or special agencies in many lands and by concert of action they inform one another, and their correspondence is as frequent as occasion requires, even though it necessitates the daily use of oceanic cables.

All this is legitimate. The information costs them much money, even into the ten thousands for some single firms. It belongs to them and they are under no obligation to divulge it, and *they never do.* Not only that but there is nothing to prevent the constant, persistent, and most diligent publication of false information, reports from foreign lands (?) exactly the reverse of what is true. And that such misleading reports are actually and most industriously published, no one can doubt who calls to mind the notorious fact that the actual and alarming shortage in European crops for the past four seasons has been concealed and stoutly denied in this country each year until the bulk of our wheat crop was largely out of producer's hands, and the profits were in the hands of heavy dealers. And this large amount of gold made by speculators might just about as well have gone out of the country, so far as relates to our agricultural and financial prosperity, indeed much of it does go out for foreign luxuries.

Nor are the producers the only ones benefited by accurate monthly crop reports, but consumers and even legitimate dealers who buy for actual delivery. And these actual dealers earnestly favor such official crop reports.

One of the heaviest grain buyers of Central Ohio, who is present in this convention as one of the delegates from our State board, was himself the one who nearly two years

ago offered the resolutions establishing the bureau of monthly statistics in our board, and placing $1,000 of our State fair earnings in the hands of the secretary, and instructing him to begin the work, even before we knew whether our legislature would vote a dollar for its continuance or not. To the credit of our legislators be it said that as soon as they found our board was really doing this practical work for the advancement of the agricultural and business interests of the State, they promptly, and I think unanimously, voted all the funds we needed to perfect and carry on the work. And I may here remark that the same will, I am sure, be true of our other State legislatures and of our national Congress. If our State boards and our national Department of Agriculture once show that they "mean business," that they have really grappled this great work demanded by the people in the interests of agriculture and of business, then sufficient funds will be speedily forthcoming. For this work is plainly demanded by all except the few who hope by withholding or perverting facts, to enrich themselves at the expense of the many and of the general good.

An important question is, how shall this work be systematized and divided up between the national department and the agricultural departments of the different States, so that all shall work in perfect harmony, the whole ground be thoroughly gone over, and none of the work be unnecessarily duplicated with results so variant and contradictory as to throw discredit upon both.

I think the *foreign* work—that of finding month by month the condition of the crops of the old world—must be done by the national Department of Agriculture. Our State boards cannot well handle it. Just how this vast foreign work shall be done I will not attempt to indicate, and am glad to leave it with perfect confidence to the wisdom of our Commissioner. For at least we have a Commissioner who holds the reins as if he knew how to *handle the team*. It is no light task to map out the nationalities of the world in comprehensive form, and show the population, production, consumption, including seed, and the consequent surplus or deficit of each, and thus deduce the grand total of the whole, viz., the closely approximated export demand, and our home surplus to meet it. It is a still heavier task to get prompt and fairly accurate estimates month by month of the condition of the important crops in every foreign nationality whose production or consumption affects the future export demand for our products, and the consequent tendency of prices. But the interests of agriculture and commerce require that *this work be done*, and *well done*, and DONE AT ONCE. And our national department is capable of doing it.

For example, a comprehensive table like the following would show where the wheat of the world lies, and where the demand for wheat exists, and how supply and demand stand related.

Table of production and consumption of wheat for 1881.

Countries.	Population.	Wheat consumed per capita.	Wheat used for bread.	Wheat used for seed.	Total wheat used.	Wheat produced in 1881.	Surplus above consumption.	Deficit below consumption.	Probable crop of 1882.
		Bush.							
United States	50, 000, 000	5	250, 000, 000	40, 000, 000	290, 000, 000	380, 000, 000	90, 000, 000	.....	(?)
Great Britain	.....	.....	.....	.....	.....	.....	.....	.....	.....
France	.....	.....	.....	.....	.....	.....	.....	.....	.....
Germany	.....	.....	.....	.....	.....	.....	.....	.....	.....
Austria	.....	.....	.....	.....	.....	.....	.....	.....	.....
Russia	.....	.....	.....	.....	.....	.....	.....	.....	.....

The figures given for the United States are simply approximate.

The last column would need to be reported monthly from May or June of each year till September. The other columns would need to be prepared for the *previous year*, each year in April or May to be ready for comparison with the monthly reports of the current year. This is but a rude plan of the foreign work now required of this department. Now, then, I say it is no light task thus to map, and bound, and lay one's hand upon the *wheat and the wheat-want of the world*, but our Commissioner *can do it with suitable aid from Congress.*

Our Signal Service, Argus-eyed, watches every cloud, current, wind, and storm; notes its center, its direction, its general direction and velocity and its violence; and then with an hundred times the hundred hands of the fabled Briareus of old mythology, it daily sends the facts over all our telegraphic lines, and posts its bulletins in every hamlet, to aid or warn and protect our navigation, our commerce, and our agriculture. *A similar service* is now imperatively demanded of this Agricultural Department in regard to the

exact condition month by month, at least, of the wheat in all the important wheat-producing and wheat-consuming countries of the world. And, as no work is more necessary, so none can be more popular; not only with farmers and business men but with our legislators. And so the necessary aid from Congress will be promptly given, if only the work is once begun.

But while this foreign work can be done satisfactorily only by our national department, the minute and accurate township work necessary in the several States can, I am sure, be best done by the several State boards of agriculture, and the main results and totals be telegraphed at once to Washington for immediate tabulation and wide publication through the Associated Press. Fuller results by mail could be given in the monthly pamphlet reports of States and nation. We, as States, can thus be the hands and eyes, while the national department shall be the head to arrange and the tongue to give forth the facts.

The advantages of this State system, I think, are many and important.

First. *Gain in time.* If individual correspondents report directly to Washington by mail, say the first of each month, then reports from by-stations in Colorado, California, and Oregon will be ten days in reaching Washington; but if the correspondents of each State report direct to their own secretary or commissioner of agriculture, then the condensation of a thousand reports can be made in a single day and night *for all the crops*, and a clear gain of a full week be made. We have *no right* to use the mails when all the heavy dealers use the telegraph. The loss of a week's time here may be the loss of millions of money to the farmers of our land. Still further loss of time would occur in the condensation of so many *individual reports* in Washington, instead of having condensed summaries from our own inland States and from foreign countries.

Second. *Personal knowledge and supervision.* In this respect the State secretary of agriculture has every advantage over the national Commissioner. The latter can by no possibility know the general condition of the whole country *by* personal inspection. The area is too immense. But for a single State this is quite possible. For example, in Ohio. Our board of agriculture manages the State fair, inspects fertilizers, and reports the crops in summer, and with the aid of our agricultural college conducts farmers' institutes in winter. In short, it has charge of the agricultural interests of the State, except the purely educational, which belong to the college. This combined work requires the secretary to travel extensively, and often in all parts of the State, and gives him the best possible chance to see with his own eyes the condition of the crops, and judge of the correctness of the reports of correspondents. It also gives him an extensive acquaintance with the best class of farmers, and a chance to perfect his corps of crop correspondents. The advantages of this personal contact, acquaintance, and supervision cannot be overestimated.

Third. *Compensation.* No direct money compensation has yet been given to correspondents, either by the State or national departments. Indeed, there are grave doubts whether it would yet be possible or wise. But all our crop reports and other printed matter, including annual reports and State fair matter, are promptly mailed to all our correspondents. Also cards, or complimentaries, are sent, inviting all our correspondents to attend the entire week of our annual exhibition—State fair—and become acquainted with our president, secretary, and members. This acquaintance is fast being extended, both at the State fair and at farmers' institutes (held in some thirty counties annually), and is a great help in the statistical work, while it increases the attendance and even the cash receipts of the State fair. This last fact is respectfully commended to the attention of other State boards.

Fourth. *Minuteness and accuracy.* The fact is an important one that we have ten times as many correspondents on our lists as the national department can have for Ohio, and more than twenty times as many who actually report. This makes our May, June, and July *estimates* more reliable. Then again our methods can be, and I think are, more exact. Let me describe them very briefly. Through courtesy of our auditor and secretary of state we now have the assessors of personal property ascertain in May the exact acreage of the main cereals for the *coming harvest.* This is no guess-work, no percentage on last year's guess. It is an accurate enumeration of acres of the then growing crops, given by each farmer in every township while the facts are still freshly in mind. It has all the accuracy of the decennial census, and the plan is earnestly recommended to other States as a basis for accurate estimates.

This acreage by townships is tabulated in our office, and as soon as the thrashing begins neat pocket folders, or "thrashers' blanks" ruled, and with suitable headings for acres and total bushels thrashed, and with full directions, are mailed to all our correspondents, for each to give to two or three of the leading thrashers in each township to record daily the results of thrashing for three weeks and then report. To illustrate, I give the actual workings in one county. Sixteen townships in Licking County reported, as given in our August report, 8,912 *acres thrashed* (up to date, August 8), with a total yield of 139,678 *bushels.* Dividing we get, as the yield per acre, 15$\frac{6}{10}$ bushels. But the total number of acres in the county is 46,298 and this multiplied by 15.6 gives

a total for the county of 722,249 bushels. Similar reports and computations for the other counties gave 38,010,057 as the total for the State. The results of five weeks more thrashing reduced the estimate to above 37,000,000, against 52,600,000, our estimate for 1880, which was probably as nearly a correct estimate as it is possible to make, viz., the exact results of eight weeks' thrashing; more accurate I believe than that made by the assessor the next spring after the farmers have largely forgotten *what their crops really were.*

These reports and similar ones from neighboring States where similar statistical work is done, showed by August, and even by July, that there was sure to be a heavy shortage in wheat, apples, and potatoes. And as the reports were widely circulated, and the main points were widely telegraphed by the Associated Press, and published in most of the daily and weekly papers, the farmers *held for* the sure advance, and got from $1.25 to $1.45 instead of 90 cents for their wheat. And so several million dollars were probably saved to the farmers of Ohio, in the sale of their wheat, apples, and potatoes, for in a few counties apples were a good crop.

These reports, if made national by counties, will show producers, consumers, dealers, shippers, and railways where the local abundance lies, and thus facilitate distribution of products and equalization of prices, and prevent waste of products in places of local abundance.

I believe the system of collecting statistics thus is more prompt and accurate, as I have said, than the national department can possibly make it by any centralized system with the individual correspondents all reporting directly to Washington. Certainly if we compare it with the work done under the last administration there can be no question. The rule "*De mortuis nil nisi bonum*," "speak nothing but good of the dead," is a wise one; and I therefore regret that truth compels me to say that much of the statistical work of this department under the last Commissioner was worse than worthless. Take a few examples at random from the last two reports, August and September; before the present able statistician had been appointed, and before the present Commissioner had taken hold of the work. The August report says (pages 14 and 15), "The condition of the potato crop, August 1, was 92 against 98 at the same date last year," and the September report gave it as 86. And this in the face of the fact that it was then known in all the main potato regions that the potato crop was *scarcely more than 25 per cent.* of the year before, in fact was, perhaps, the most *disastrous failure* for a decade. And so in a few weeks from the time this department had sagely stated that we had 92 per cent. of a full crop, the anomalous fact stared us in the face that we were *importing potatoes from abroad*, and that they were selling in our cities by the car-load on track for $1.20 per bushel, and retailing at 35 cents to 45 cents per peck.

Again this department quoted apples in August at 70 per cent., and in September 66 per cent. of a full crop, instead of 25 per cent. or less, as was true. And to-day good apples retail in most of our cities at $4 per barrel and 50 cents per peck. Spring wheat is given as 82 per cent. in Ohio, whereas *no spring wheat is raised* in the State. In September, reports from only ten counties in Ohio are given, and yet on this ridiculously inadequate data the winter wheat average of the State is based. The Illinois wheat is given at 60 per cent., whereas it was then definitely known to the State secretary of agriculture that it could not exceed 35 per cent. And this gives an overestimate of 14,000,000 bushels in a single State. And the facts now show that that State will have scarcely 4,000,000 of good wheat to sell, above seed and bread for her own people, against 40,000,000 to export the year before.

These are but a few of many facts that prove the figures and estimates to have been utterly unreliable—prove that this department failed to discover *wide-spread failure and disaster* in a whole State, and even in the whole country. Such reports are an outrage, a disgrace, and a great damage, and brought contempt upon an administration that was wasting its strength on tea that would sell at nineteen cents per pound, and on molasses that cost a hundred or a thousand dollars a barrel, and neglecting these important statistics of our heaviest products.

How shall the present Commissioner and his able statistician redeem the statistical department from odium and restore its credit? In all cordiality I say, in no way so surely as by accepting the hearty co-operation now freely offered by the great grain States of the West, where efficient systems of monthly reports are in existence, or to be begun the coming spring.

One fatal mistake of the last Commissioner was that he cut loose from the sympathy, co-operation, and advice of those officially in charge of the interests of agriculture—boards of agriculture, agricultural colleges, and agricultural papers. The present convention is one of many proofs that his able successor is pursuing and will continue to pursue exactly the opposite course. If he shall only succeed in establishing a system by means of which all the people shall know promptly and accurately, month by month, *the condition of the grain crops of the world*, he will have accomplished a great and valuable work. And I believe Congress should not hesitate to make all reasonable

and necessary appropriations for carrying forward a work so essential to our national prosperity.

The PRESIDENT (Dr. LORING). The convention will pardon me at this time, if I make a remark or two with regard to the paper just read—a paper which I consider literally crowded from the very beginning with valuable information. I don't think that I have ever listened to a more substantial and valuable essay on any public occasion. No one more appreciates the value that the statistics of the country have bestowed upon the agricultural popualtion of this country, than I do. Their value has become incalculable, and so important that the business of the country cannot get along without them.

Prompt and accurate information of our improved methods of transportation, improved processes in manufacture and all industrial pursuits secured in every section of the country, should be laid before our people. The accurate farmers of to-day are just as much interested in the statistical conditions of the manufactures of the world as were Boston, New York, or Philadelphia fifty years ago; and I believe it is as manifest to this convention as it is to me, that they are entitled to it, not as the results of voluntary contribution, but from the results of true, carefully compiled information, from a duly constituted and regularly compensated labor, paid for by the general government itself. [Applause.] Now, I have not been in the habit of criticising our public servants. Somehow I have always had unbounded faith in them as a rule. It has always seemed to me that every government official, every man in Congress, every governor, every man clothed with authority of whatever nature, must of necessity hold himself to that responsibility due to his position; but I have been peculiarly impressed with certain defects in relation to the management of certain branches of government, which Mr. Chamberlain has referred to.

My attention was early called to the statistical bureau of this department. Of course, I turned my eye, in the first place, to the recorded reports of my own State, because I naturally felt more or less familiar with the several counties reporting. I found to my astonishment in the statistical report of last June that in Berkshire County the average of grain growing had increased, but in Suffolk County it had diminished. Now Berkshire County is one of the western counties of the State, where the production of grain is always large; and Suffolk County, where, as the report says, the production of grain was limited on account of the overabundance of water, is the city of Boston and the harbor. [Laughter.] I remember reading an incident which was reported some time ago, to the effect that on a certain date a flock of wild geese flew over the town of Rowley. Rowley is a small town lying on the seaboard, and is so situated that wild geese in their migratory passage must of necessity fly over it; but I must confess that I have yet to see the necessity of making a record of the flight. [Laughter.] Now, it seems to me that accurate and important statistics have become one of the objects of popular demand, and their publication a necessity of the day.

On the 19th of last August I had the honor of presenting to an assemblage, at the opening of the Manufacturers and Mechanics' Institute in Boston, a statement in historical detail of the remarkable growth of the manufacturing industries of the country for the past fifty years. The manufacturers listened with the deepest interest and surprise; and I am sure that the effect has been to give a new impetus to the manufacturing enterprises, whose marvelous history I portrayed.

At agricultural conventions and twice at Atlanta the past autumn,

I have endeavored to present such accurate statistical tables to my audiences as should give them some measure of comprehension of the enormous progress we are making as an industrial people; and everywhere they have been received with profound attention and interest. The more they heard the more they desired to know; and I have always found that the great stimulus of enterprise has been derived from a knowledge of what enterprise has done and is doing. I have been so impressed with this idea that I have in my own mind pursued exactly the train of thought laid before you this afternoon. I have been endeavoring to ascertain to my own satisfaction the way in which this department, as representing the greatest industry in this country, could avail itself of the most thorough and accurate facts. Now, I am not sure that voluntary contributions are always safe, however faithful and conscientious the correspondent may be. I know there can be, in each State, an organization of such a description that the information it secures may be reliable and that part of that information may be voluntary. But the main facts, the underlying system of collection, and the conclusions deduced therefrom must be secured by proper officers in the employ of the government itself. The amount of money necessary for this would be by no means large, and where properly used could be made of great service.

We have in the State of Massachusetts a system of this description managed by an accomplished statistician, the Hon. Carroll D. Wright, who is head of our bureau of statistics and labor, and every one there understands that the statements which he makes with regard to the statistics of that State are thoroughly and absolutely reliable. His official corps is small and the expenses of his office are light, but his work is invaluable and complete. On the question of labor I obtained from him and from the Census Bureau under this government a vast amount of valuable statistics and facts to submit to the manufacturers and mechanics of New England last autumn. Now I think there can be a union between this department and the State bureaus for statistical purposes—a valuable, reliable, and important union. So convinced have I become of this that I have already presented an estimate to Congress for ten times the sum usually asked for for this work. Usually there has been appropriated $10,000 to the statistical branch of the department. But I trust this matter may be presented to Congress in such a strong light that there will be no hesitation in increasing this insufficient sum. In the estimate I made for the succeeding fiscal year I have asked for $100,000. [Applause.] Whenever I shall be called to go before the Committee on Agriculture to explain this estimate, I shall feel that I am strengthened by Mr. Chamberlain's paper to which we have just listened. It has convinced me, and I trust it has convinced every member of this convention, that the statistician of this department can put himself in immediate communication with the statistician in each State of this Union where there is one. There is no reason why statistical information should be collected for this department and paid for by the State of Ohio, for instance. On the contrary, there is every reason why the general government should employ persons in Ohio to furnish facts and figures that will be of use to the whole country, and while the statsitical branch of this department in securing all those commercial facts to which the paper has alluded, and all facts relating to foreign crops and commerce, a proper combination between the States themselves and this department will secure all the rest of the information we so desire.

Let me add that the census returns of the industries made every decade are unequal to the wants of the country. The whole industrial population of the country will grow old and pass away in but little more than that time, and a new generation will come in, and set itself to work. The growth is so enormous that it is impossible to appreciate the increase from one decade to another. For instance, I am told in the statistical returns for 1870 that the corn crop was 750,000,000 bushels. I go struggling on ten years, and all at once day dawns. I look at the figures and behold! it has increased to 1,750,000,000. In 1870, I am told that the wheat crop (as I told you the other day) was 240,000,000 bushels. I am told by the census of 1880 it has increased to more than 450,000,000 bushels. Now, why should I wait ten years for this information? With one-quarter part of the expense which it takes to secure these figures every ten years, a flood of information can be poured out to the farmers of this country every year, which in its value would be almost incalculable. [Applause.] This can be done by the simple organization of a proper statistical bureau, which shall furnish a careful estimate of foreign crops and foreign commerce, and which shall put itself in communication with intelligent parties in the various States, who know what is going on about them. Statistical estimates secured in this way would be valuable and important, and I would present to this country, through such a bureau, an accurate statement each year with regard to the manufactures and other industries that are making us so rich and so powerful as time goes on. I am unwilling to wait ten years to know how much the cotton spindles in this country have increased; I am unwilling to wait ten years to know what the freights and fares of our railroads are; I desire that the people of this country shall know year by year the exact facts in order that we may understand what our rights, our wrongs, and our duties are; for when this knowledge is based on accurate information we know exactly where we are as a powerful, enlightened, and prosperous people. [Applause.] I am aware that the enumeration of the population may properly be taken every ten years. This enumeration of the people of this country in its various States and districts is a matter of the greatest importance and should be accurate, both for the purpose of dividing the country into Congressional districts, and that we may comprehend our educational, labor, and industrial systems in all the arts of life. Therefore let us have a census made up every ten years of the increase of our population, and then let us have an annual enumeration of the growth of our industries, so that the growing population may know what to depend upon; that the grower of corn, and of wheat, that those who are interested in the great industry of this land—the animal industry—horses, cattle, sheep, swine, wool, hides, leather, bones, and the rest, may know exactly where they stand. Now, I have made this statement because it grew naturally out of the paper just read, and I desire to express my gratitude to the gentleman from Ohio [Mr. Chamberlain] for furnishing me with an unanswerable argument with which I can support myself in my modest demand for $100,000 to put this department upon a good statistical foundation, preliminary to that time when it will be placed on a broader foundation where it will represent the statistical, the agricultural, and the mechanical industries of this country accurately and well. [Applause.]

Mr. GILLHAM said: In view of the admirable paper of the gentleman from Ohio, and the great amount of information it contains, which this convention has so much enjoyed, I desire to offer the following preamble and resolutions:

Whereas it is a matter of great importance to the agricultural interests of this country to have full and accurate statistics of the agricultural productions of the United States and foreign countries promptly published, in order to enable all interested to determine the tendency of prices and the probable demand for our surplus productions: Therefore be it—

Resolved, 1st. That this convention request the Congress of the United States, now in session, to provide by law for the collection, through the foreign service of this government, of the agricultural and commercial statistics of other nations.

Resolved, 2d. That the United States Department of Agriculture, and the several States and Territories, through their boards of agriculture or otherwise, be, and they are hereby, requested to co-operate in the work of collecting and publishing full, prompt, and accurate statistics relating to the agricultural productions of the United States.

Resolved, 3d. That the chairman of this convention, the honorable Commissioner of Agriculture of the United States, be, and is hereby, requested to furnish the President of the Senate and the Speaker of the House of Representatives, each, with a copy of the foregoing preamble and resolutions, and urge the passage of a law by Congress providing for the collection of agricultural and commercial statistics of other nations.

The resolutions were on motion adopted.

Mr. CHANEY spoke of the importance of our having foreign crop statistics. In the year 1878 we had an immense wheat crop in this and other of our winter-wheat growing States. The idea had been promulgated by the papers and politicians that there was an overproduction. Buyers, therefore, offered low prices. We regarded England, therefore, as our main purchaser of wheat, notwithstanding all the large requirements of the continent. The result was that the farmers sold out the stock of wheat in several counties in Ohio at 80 cents a bushel. He was a buyer and a miller, and paid as close attention to the market as any one, and when no reports whatever of the shortage of the continent was received we were without information of the condition of the market. The continental buyers came in and bought their supply in a short time. The result was that our wheat sprang up in value from 80 to 95 cents a bushel in a short period. Our buyers and dealers did not know the cause. The French buyers again left the market, and it dropped down to 80 again. The buyers here had only had the information they received through this department officially, and they bought accordingly.

It was believed that we had an immense crop—far beyond what we really had. What we want is to be posted every way as to the prospects of the crop of continental Europe.

The PRESIDENT. Mr. Blue will now present a paper on the history and value of agricultural statistics in Canada.

Mr. BLUE. Mr. CHAIRMAN AND GENTLEMEN: I may remark that I had no intention of reading a paper to this convention when I left home. The paper I have is really a government report, and is, in a measure, confidential. Some of the delegates have, however, urged me to read such portions of it as shall not violate this confidence, which are the portions relating to the value and history of agricultural statistics. Before passing to the reading of the proof-slips which the printer handed me the evening before I left home, I want to say that I think it would be a good idea if there could be established an international crop system on this continent, especially between the United States and Can-

ada—as we have already an international Signal Service—and one is just as important as the other and will become more and more so every year.

The province of Ontario is now the chief grain-growing province of the Dominion, but the time will soon come when the Northwest will not only be the first grain-producing section of Canada, but also of the continent. There is the *habitat* of spring wheat. In no other part of the world does spring wheat attain such perfection as in the Canadian northwest, where there is an area of 150,000,000 of acres, every acre of which is well calculated to grow spring wheat. This country is being opened up very rapidly. During the past year a great many emigrants have settled there, and I think it very desirable that we should have an international crop-reporting system between the United States and Canada.

AGRICULTURAL STATISTICS: THEIR VALUE AND THEIR HISTORY.

The husbandry of the past fifty years is a record of marvelous progress, both in methods and results. Intelligent farming is no longer confined to a score of men in a country, or one man in a county. We see the evidence of it on every side—in the use of labor-saving implements, in the increase of improved breeds of live-stock, in the drainage of the soil, in the rotation of crops, in the application of fertilizers, in the development of the dairy system, and in the great diversity of products of the field, orchard, and garden. There has been a steady and general leveling upwards.

Throughout this period governments have taken a keener interest than ever before in agricultural affairs. In every country of Europe, with, I believe, the single exception of Turkey, there is a ministry, bureau, or sub-department of agriculture, with an organized system for conducting inquiry and reporting facts in all matters affecting the interests of the farmer. The same thing is true of the United States, as well as a number of individual States, and also of my own country, though in a less degree.

By encouraging exhibitions, collecting and publishing valuable information, introducing new breeds of live-stock or new varieties of grain, fruit, and seeds, taking measures to check the ravages of disease upon animal or plant life, and establishing colleges and experimental farms for the special education of farmer's sons, governments have done much to aid and direct the operations of the husbandman, and to give him larger profits for the fruit of his labor.

No one seriously doubts the utility of correct information on the supply of food, to town and country, to rich and poor, to farmers and merchants. It enters largely into the commercial combinations of every year, and is one of the chief elements affecting circulation.

This is a field in which governments have almost exclusively the means of making an extensive series of observations, and perhaps no greater service could be rendered to the farmers and business men of the provinces of the Dominion and the States of the Union than to collect reliable statistics of their agricultural wealth from year to year.

THE VALUE OF STATISTICS.

The value of statistics is apparent in this, that it is mainly through the pursuit of statistical inquiries we can be assured of real advance in the knowledge of human interests. The statist aims at discovering the actual condition of his country and the causes of that condition, with a view to discover also the methods of improving it.

By the aid of statistics just data are supplied to guide the exertions of the philanthropist, the judgment of the legislator, and the speculations of the reasoner. Facts unimportant in themselves, as George Lewis has observed, become important as units comprised in a complete enumeration, and results are thus obtained to which mere conjecture, or the loose and vague impressions derived from a partial observation could not have led.

Figures give definiteness and precision to ideas. With regard to questions of drainage, ventilation, food, and the use or abuse of strong drinks, it is the statistical information supplied on a large scale which alone can be conclusive. It is the essence of statistical inquiry that by dealing with masses it eliminates individual peculiarities.

Statistics of the census, post-office, customs and excise, and the courts give to us

collectively the social and economic history of the age in which we live. They prove that there is uniformity in all human affairs, and there is permanence and steadiness in the laws which regulate our existence. From statistics history borrows a considerable portion of her light, to general public law they contribute most valuable materials, and they enrich politics with a multitude of practical data.

A report showing the actual territorial wealth of the country, the different branches of its produce and the mean returns which they afford, would be invaluable to the economist and the legislator. By proving numerically the happy effects of any measure of economic legislation the trustees of power would be taught the superiority which may be acquired by the prompt imitation of nations most advanced in agriculture and manufactures, and in the manual perfection of the arts and trades. Government has an interest in the enlightenment of laborers, whether agricultural or mechanical, for they are the real producers of wealth. It is its duty to do for them collectively what they have no means of doing individually, or even by organized association.

The value of information depends on its accuracy. An annual record of trustworthy facts, setting forth the productive power and value of both land and labor when employed to the best advantage, could not fail to produce a healthy, stimulating effect. The influence of thousands of good examples would tell powerfully in favor of advancement all along the line. The counting of cows, a distinguished English agriculturist has remarked, is the first step towards their universal improvement—especially should the count give their annual product of butter and cheese.

Our farmers have great advantages for the economical production of beef and pork, mutton and wool, and it will render them a valuable service to obtain correct information of all discoveries and improvements either in the growing and feeding of domestic animals or in the curing of provisions; also as to the number of animals fattening in the country, and the probable demand for them in the home and foreign markets.

The profit is in the last few extra pounds of meat or cheese or butter, as well as in the extra bushels of wheat, corn, or barley. How to produce this extra is a question of vital moment to every farmer, and to the whole country. If by an improved system of tillage, or the use of fertilizers, the average wheat product of the country can be increased by one bushel per acre, the aggregate gain will be very great. On the area in Ontario, as given by the census of 1871, it would be nearly a million and a half of bushels.

In one of his letters to Sir John Sinclair, Washington says that when he entered the public service in the Revolutionary war his flock of 1,000 sheep clipped 5 pounds per fleece; when he returned to his estate at the close of the war he found his flock so degenerated, under the care of a foreman of the old school, that the average clip was only 2½ pounds, then, as it is now, the average yield of the Virginia sheep. In Ontario, according to the census of 1871, the average was 4½ pounds, but we have many flocks of long-wooled sheep that yield as high as 8 and even 10 pounds. A fair average, with intelligent care in feeding and breeding, should not fall below 6 pounds, and this on the sheep census of 1871 would give us an extra 3,000,000 pounds for the whole province, or an annual addition of $1,000,000 to its wealth by wool alone.

The great defect in our agriculture is the failure to rear the proper number and quality of animals. If the quantity of live stock were doubled the aggregate of grain produced might also be greatly increased, without any corresponding increase in expense. But there is danger in running to extremes; the farmer must seek to avoid over-production.

At present, industrial facts are ascertained for us by the census, which is taken only once in ten years. But the whole condition of agriculture may change in that period, so that at best the information of the census can be only a subject of curious interest to the farmer; it will not help him to decide what he fairly ought to get for his grain and live-stock, and whether to sell or to hold; it is gathered and published at too wide intervals of time for practical usefulness or guidance.

Agricultural journals and the daily and weekly newspapers are doing invaluable service to the country, but they cannot work under an organized system, nor cover the whole ground of inquiry. The experience of the ablest and best conducted journals of England, the United States, and our own country is that, with the most painstaking effort, the collection of statistics and reports is fragmentary and unsatisfying. Governments alone can do the work efficiently and continuously.

Every farmer knows that the price of his products is regulated by the law of supply and demand. Prices naturally tend to the equilibrium found under this law, and for a high price obtained under a false impression of scarcity the producer pays the penalty through prices running to the other extreme.

The grain-dealer or the speculator on the corn exchange, with a longer purse and better means of information than the isolated farmer, can learn the probable yield of crops sooner than any one else, and may sweep the markets before prices have moved

But if statistics were furnished by the government every one would be as well supplied with information as the dealer or the speculator on the exchange. Hence the value of authentic reports on the condition of crops throughout the country and the world.

The misrepresentation of crop reports—which is a common device of speculators—is hurtful to the farmers, who are for this reason deeply interested in having trustworthy information. They have the earliest command of the market, and may take advantage of that position if they have the means of accurately anticipating the course of prices. It is no gain to the consumers that dealers or speculators have bought in a low market. They must pay the figure as fixed by supply and demand, and the lion's share of profits is seized by the middleman. Accurate statistics and reports, affecting the commercial dealings in farm stocks, would enable the producer to get a more equable distribution of profits, and to steadily increase his productive capital. At the same time they would aid the dealers who do a fair and legitimate business; it is the gamblers on the great corn exchanges who work mischief to farmers and to the trade.

A few illustrations of the practical use and value of crop reports as collected in an imperfect way by the bureau at Washington may prove instructive and interesting.

The corn crop of the Union for 1873 was injured by the fall frosts to the estimated extent of 135,000,000 bushels. When this fact became known through the monthly report of the Agricultural Department an advance of 20 cents per bushel was established, and the farmers reaped the benefit of it. The October report for the same year showed a decrease in the hog supply, and the market for hogs likewise improved immediately.

In the January report for 1873 the secretary of the Agricultural Association for Perry County, Indiana, writes:

"About the time of the potato harvest this fall (1872), our producers were all astray respecting the market value of the potato crop—one of our main crops in this section. This uncertainty was taken advantage of by buyers, and they swarmed down on our producers early in the day, offering 50 cents per bushel. Some accepted the offer, but the vast proportion of our farmers concluded, at the request of the association, to await the report from the Agricultural Department. It reached us in proper time, and a careful analysis was made of its reports of the potato crop. Our people acted on it, and the result was a gain of many thousands."

The low price at which the few sold was no gain to the consumer, and the high price was no loss. Under any circumstances he was bound to pay the price fixed by the demand, and the speculator only failed to make large gains through the producer refusing to sell at his offer. By waiting and taking counsel of the reports the farmers themselves got the benefit of the good prices, and it is a sound maxim that the profit should go to the men who earn it.

But the work of the bureau at Washington is too imperfect to foil the designs of the speculator, or to correct the misrepresentation of crop reports so as adequately to protect the producer against loss. In the first place, the number of correspondents is limited—there being only four thousand for the whole Union, or an average of two for every three counties; and in the second place, the reports are not issued with sufficient promptness. The consequence is that the speculator is given a margin of time for his work.

It is a well-known fact that an assumed or a reported scarcity has at first the same effect on prices as a real one has. The rise is just as rapid, the fluctuations just as violent, and the final result more disastrous. What occurred in 1879 will show how the game of the speculator is played.

As early as the 1st of July the heavy grain-buying firms of New York and Chicago knew that the wheat crop was abundant in their own country, that it was a failure in Great Britain and some of the European states, and consequently that the export demand would be very great. They had experienced men moving about in the country getting accurate information, and local buyers who made regular reports on the state of the crops. Upon the facts collected in this way, and which were sacredly treasured in their own offices, the grain kings formed their judgment; they gave to the public only what served their own ends. The fact that there was a large foreign demand they either suppressed or denied, and the fact that there was an unusually large crop in their own country they brought out with emphasis. If the farmers were as well informed as the leading buyers they would have held on for an advance; but they were not, and before the issue of the Washington report a great portion of the winter wheat south of the latitude of Chicago was disposed of at 90 cents per bushel. The price then quickly rose to $1.20 per bushel, and the farmers of the spring wheat belt were paid about $1.30. The wide margin of profit on early sales, which should have gone to the farmer had prompt information been given by the bureau, was swept by the New York and Chicago dealers as their winnings in the game.

Large quantities of the wheat in store were disposed of at a fair market price, but the more reckless speculators resolved on another move. They determined to force up the price of wheat by pointing to the great foreign demand, and declaring that the

home crop had been largely over-estimated. But this stratagem had no effect on English buyers. They had the carefully-collected crop reports of their own country, of the wheat-growing countries of the continent, of the Australian colonies, and of the bureau at Washington, and they knew that the wheat supply of the world was ample for the wants of the year. They bought wheat everywhere but in New York and Chicago, and the result was that in a few weeks the American ring was broken. The speculators were not strong enough to carry their load; but, besides the serious fall in prices, their collapse came very near to precipitating a commercial crisis. Early, accurate, and generally diffused information as to the state of the crops at home and abroad would frustrate all such attempts of the grain speculators to "bull" or "bear" the market.

Another instructive lesson is furnished by the crop and stock reports of Ohio. The wheat crop in that State last year was fair, and had it been equally good all over the country the price would probably not have gone above $1.20 in Chicago. But the reports for Illinois, Iowa, and Michigan—the only other winter-wheat States that have adopted the plan of monthly crop reports—indicated that for those States the yield would be less than half that of the previous year. This information was promptly given to the press of the whole country, and advance sheets of the most important points and conclusions from each month's report were sent out in the same way. The Ohio report for October says:

"Farmers read the facts in many papers and on every hand, and the whole community came to believe and know that at least the wheat and corn crops of 1881 were really short, and that prices must rule high; and, as a rule, the farmers held and realized the profits that legitimately belonged to them. And so this information thus gathered by the State boards of our own and a few other States, and thus widely published, has, in the opinion of judicious men who are acquainted with the facts before and since this work was begun, been worth more than $10,000,000 to the farmers of Ohio alone. For that sum would be less than 30 cents a bushel on this year's crop, and that 30 cents (or $10,000,000) would have gone largely into the hands of speculators but for this prompt and reliable information in the hands of the farmers and of the public generally. Indeed such was really the case with the crop of 1879, before this crop report work was begun by any State except Illinois."

Owing to the long-continued drought last year the bean crop was short in Ontario, and also in New York and Michigan. This was known to dealers early in the season, and before the crop was fully harvested a great portion of it was secured by their agents at prices ranging from $1.25 to $1.60 per bushel. A few weeks later it was quoted in the Detroit and Montreal markets at $3 per bushel, and the lumbermen of Michigan and the Ottawa Valley who had delayed the purchase of supplies were obliged to pay outside figures to the speculators, who were thus well rewarded for the cost of early information. Under an efficient system of collecting and publishing crop reports this advantage would have gone to the producers.

These illustrations will suffice to make clear the practical value of statistics and reports, both to the producers and the consumers of food. Other uses which they would serve I need only indicate.

They would encourage the keeping of farm accounts—necessary in order to make fairly accurate returns.

They would direct the purchasers of live stock to the sections in which supplies may be most easily obtained.

They would give a basis of certainty upon which to compute the country's annual surplus of products, or its requirements.

They would serve to prevent panic and sudden and unnecessary fluctuations in prices.

They would, by showing the probable extent of employment in the carrying trade, enable the shipping and railway interests to make timely provision for it.

They would mark the tendency to over-crop, and, consequently, to impoverish the soil, and demonstrate the value of fertilizers and the importance of a reform in tillage.

And lastly, they would note the resources of the country, its capabilities and its progress in material wealth, and so serve to attract population and capital from other lands.

To ascertain the present state of the country, to compare different places at the same time, and the same place at different times, are objects of great interest to every citizen.

THEIR HISTORY.

Having considered the uses and purposes of agricultural statistics, I propose in the next place to treat of the subject briefly in its historical aspect. This is desirable in order to show what other countries have done, and to learn what their experience teaches.

In Great Britain statistics of every kind have made slow progress. It took nearly half a century to carry a measure in Parliament for taking the census of the nation, the

first bill having been introduced in 1753, and the first census taken in 1801. The various published statistics consisted for many years of returns to Parliament presented without regularity or order, and it was not until 1832 that a statistical department was created at the Board of Trade, with the object of arranging and systematizing publications and returns. Since that year statistical offices have been created in connection with other departments; but various reforms have been made in the conduct of the work, and a royal commission, appointed in 1877, has been engaged for four years in an effort to simplify and systematize the whole body of statistical returns. Their report, which is exhaustive and valuable, now awaits the action of the government.

In England it required the lifetime of a generation to remove the prejudices of the farmers against the collection of agricultural statistics. They feared that the scheme had something to do with local rates or the national taxation, or that it was a device of landlords to learn their true condition and raise the rents.

In 1836 Mr. Poulett Thompson, president of the Board of Trade, conceived the idea of collecting information through the clergy, but prudently resolved to test his plan at first in one county. Printed forms were prepared asking for returns of the whole land—wood, waste, and under cultivation; the acreage and yield of the different crops; the number of each kind of live-stock, and the average rate of wages. These were sent to the clergymen of 126 parishes in the county of Bedford, but the result was so unsatisfactory that the plan was abandoned as hopeless; only 27 of the 126 clergymen made any return.

Various other experiments were subsequently made, and the subject was taken up in Parliament. From 1845 to 1864 bills and resolutions were introduced and discussed session after session, and a score of schemes were considered, only to be dropped or rejected.

In 1853 authority was granted by the government to conduct an experiment in two English counties by the poor law board, and in three Scottish counties by the Highland Agricultural Society, under a scheme prepared by its secretary; and in the following year the experiment was extended to eleven English and Welsh counties, and to the whole of Scotland. The making of returns was purely voluntary, but while in Scotland the extent of failure was less than one-fifth of one per cent. it was in England 7 per cent. The difference of results was attributed to the kinds of machinery employed; there was a strong prejudice against the poor law board, and the Highland Society was trusted as the farmers' friend.

No further effort was made at that time to collect statistics in England, but the work was continued in Scotland until interrupted by a dispute over patronage and the audit of accounts. The treasury asserted its right to name the collectors as servants of the government, and insisted upon all accounts passing through the board of audit. The secretary of the society refused either to yield the patronage or submit to an audit, and he settled the dispute by stopping the work.

The success of the experiment, however, proved the value of such statistics, and helped to remove the prejudice against them. Finally, in the session of 1864, a resolution was carried in the House of Commons affirming that the collection of agricultural statistics was desirable, and in June of the following year the president of the Board of Trade asked for and obtained a vote of £10,000 to enable him to effect the aim of the resolution.

In the same month the rinderpest made its first appearance in England and spread rapidly throughout the kingdom. A royal commission was appointed to consider its origin and nature, and after taking some evidence they wrote to the Board of Trade urging "the importance of obtaining correct information respecting the number of horned cattle and sheep in the country." The board concurred, expressing the opinion that if such information were obtained it could not fail at that time to be of great utility and interest to the agriculturists and to the public at large. Orders were forthwith given for the preparation and distribution of schedules, and it was expressly stated that "the number of live stock belonging to individual persons will not be divulged." The returns were made on the 5th of March, 1866, through the medium of officers of inland revenue, and the report was published on the 7th of May. It gave the number of cattle, sheep, and pigs in each county, the number of cattle that died or were killed on account of the plague up to the week ended 21st April, and also the percentage of losses.

This was the initiation of agricultural statistics in England and Wales, and, as already indicated, it had its immediate origin in the incidence of the rinderpest. The preventive measures to check the disease, and the scheme for compensation accorded to those whose cattle were sacrificed in order to save the stock of others, almost necessitated a cattle census. Its practical use was so apparent that the action of the Board of Trade met with ready approval, and when it was followed up in the same year by a request for the acreage returns a very friendly response was made. These returns when prepared and issued were largely circulated in the agricultural districts for the purpose of making known the information afforded by them, and also of show-

ing that nothing was published which could in any way injure the interests of individual occupiers of land.

In this way the farmers of England became convinced that the collection of statistics was a matter of special interest to themselves, that it was not a device to increase rent or taxes, and that even its inquisitorial character was redeemed by a worthy object.

The information contained in the returns consists of the total area of land occupied; the acreage under each kind of crop, bare fallow, grass, and permanent pasture; the acreage under orchards, market gardens, nursery grounds, and woods; and the number of horses, cattle, sheep, and pigs.

The great number of occupiers and owners of land in Great Britain makes it necessary to have a large staff to collect those returns, and the officers of inland revenue have been selected for the work by the government, "as a convenient and efficient local agency to obtain the information with as little trouble as possible to the occupiers of land." It is the duty of these officers to distribute and collect the forms, and to tabulate them for the counties. The forms are issued to all occupiers of land—stamped for free transmission by post—and thus a ready means is afforded for their prompt return to the local officers. In cases where the returns are delayed or refused, the officers are required to collect them personally, or make estimates from their own observation, which is the cause of considerable delay in their reports to the Board of Trade.

The returns were at first collected on the 25th of June, but in 1877 the date was changed to the 4th of June, the object being to secure earlier publication. In that year the summary was issued on the 21st of August, instead of the middle of September as in previous years, and the complete tables and report at the end of September. Last year the summary was issued on the 15th of August, and the complete report on the 24th of September. It is also found that by the change to the earlier date in June the farmers have more leisure for filling up the schedules, and that some who flatly refused to do the work before, during the busier season, do so now readily.

In 1876 the acreage obtained by estimate in England—where farmers refused or neglected to make returns—was 2,178,515; last year it was only 1,584,228 out of a total of 32,211,512 returned, or 5 per cent. In Scotland last year the acreage estimated was only four-fifths of one per cent., and in Wales only one-tenth of one per cent.

In his report last year Mr. Giffen remarks that, especially in England, "the tone of the collectors as regards the disposition of farmers to make returns is in many districts more and more satisfactory every year, and on the whole there is a steady improvement." I need only add that in Great Britain the statistics are collected without legislative authority, and that the giving of information is purely voluntary; the duties of collectors alone are mandatory.

The average prices of agricultural produce in England are published weekly and annually in the London Gazette, as directed by acts of Parliament. The basis of the weekly average is a division of aggregate proceeds by aggregate quantities sold, compiled from all markets prescribed by the statutes, and the annual statement is made up from the weekly returns. The Scotch plan—the primary object of which is to fix the tithe commutation—is by means of an assessment jury summoned by the sheriff and examined on oath, whereby the value of grain not sold but used at home is included.

Ireland possesses a very complete system of agricultural statistics. It had its origin in the period of the potato famine, the first report covering the years 1847–'48, and its value was so clearly demonstrated at that critical time that it has been maintained ever since. Besides being thus commended by long use, the plan has been indorsed by the International Congress of Statisticans, who have adopted it as their own and recommended it to other countries.

The data of the returns are collected by members of the constabulary force, who visit each farm or holding to ascertain from the occupier or some other person connected with the farm the particulars required. This work is carried on under the superintendence of the registrar-general at Dublin, and his reports are made to the lord-lieutenant. An abstract is published at once and the detailed report is presented to Parliament. Briefly stated, the returns show:

1. The extent of tilled, untilled, and waste land, the number of holdings and their size in statute acres, and the number of stockholders and quantity of live stock—by poor law unions, baronies, counties, and provinces; and

2. The extent of land under crops and its value, the estimated produce of the crops, and the number of holdings exceeding one acre—by poor law unions, counties, and provinces.

There are also comparative statements under each of the above heads, embracing a period of ten years, the number of scutching mills in each county and province, tables of meteorological observations, and remarks on the probable cause to which the good or bad yield of the various crops in each district may be attributed.

The enumerators number about 3,400, but being in the regular service of the Gov-

ernment they receive no extra pay for the collection of statistics. The work is commenced on the 1st of June, and usually finished by the end of July. The names of the several parties from whom the particulars of tillage and live-stock are obtained are given in the returns, with a view to further inquiry should it be found necessary.

The abstract report of the registrar-general is prepared from summaries made by the enumerators, and is limited to showing the acreage under crops and the number and description of live-stock in each county and province. The estimated produce of the crops is reserved for the detailed report, based on information given to the enumerators by practical farmers and others qualified to form an opinion as to the yield in their respective districts.

The registrar-general bears testimony to the courtesy of all classes connected with the land in giving the information necessary for compiling the statistics, and to the zeal and efficiency with which the enumerators discharge their important duty.

In Belgium and Holland every kind of information connected with agriculture is collected under the superintendence of a body of gentlemen, usually proprietors of estates, who are elected for purposes of local government. Returns are made to these officers at certain periods by farmers or occupiers of land, and the result is every year the subject of a detailed report printed under authority of the governors of the provinces.

In France the ministry of agriculture collects monthly reports on the cereals in the agricultural districts and the result of the various crops, and compiles other special statistics—the number of live-stock, on silk-worm rearing, vine culture, &c. The local returns for the ministry are prepared by the *prefets* from the statements of statistical district committees.

Hungary, which is eminently an agricultural state, devotes great attention to the work. The product of the crops is collected yearly by means of inquiry forms, which are distributed to every parish and filled up by the parish magistrate, with the assistance of the most intelligent farmers. The forms are then collected, examined as to the correctness of their filling up by the statistical commission of the district, and sent in to the statistical bureau for the county and country summaries to be compiled and published. The data relating to vine culture and agricultural implements and machines are worked out in the same way as those of the crops product, with this exception, that the implement statistics are not collected annually, but at uncertain intervals when required.

In Austria and Austro-Hungary very full statistics of crops and live-stock are procured. In the latter country the statistics relating to the crops collected since 1869, and those relating to the annual increase of cattle, first published in 1875, are based upon estimates of the greasest possible accuracy and extent, "prepared by unprejudiced men well acquainted with the agricultural characteristics of the various Crown lands." These estimates, an official report states, "are preferable to figures worked up by men little acquainted with the subject, and possessing small skill in arithmetical manipulation." For the same reason the original inquiry forms are sent in to the bureau without any working out, experience proving that accuracy of statement and promptness in publishing the returns can only be secured when the actual first entries are laid before the figure critic. The information relating to crops is supplied by the agricultural unions, who prepare the facts for their own districts.

The states of the German Empire had their respective systems under the Zollverein, but in 1870 a commission of statists and administrative functionaries met to develop a uniform system. The work of the commission was not completed until the following year, when the Empire was established, and their report was made the basis of an Imperial system of statistics. It consists in the collecting and compiling of information furnished either exclusively by, or in co-operation with, the governments of separate states, according to special instructions from the Imperial authorities. The agricultural statistics of the Empire under this plan were first collected in 1878. They are given under three heads, viz: (1) Agricultural employment of the soil; (2) Proceeds of the harvest; and (3) Returns of live-stock, and are very elaborate.

The various other countries of Europe have their several systems, but those of Sweden and Denmark are the most complete, giving the acreage under crops and grass, estimated quantities of the crops produced, and the number of live-stock.

The present advanced state of agricultural statistics in the old world is largely due to the teachings and the influence of the International Statistical Congress. The resolutions of this learned body, adopted in 1877 at the meeting held in Buda-Pesth, are in substance as follows:

1. The governments of all countries to collect special meteorological observations in connection with agriculture, to be submitted to a central authority, elaborated, and published regularly.

2. To have regular monthly reports by special agents (crop reporters) on the state of cereal vegetation in their districts.

3. To secure observations regarding the influence of the destruction of forests and of replanting on climate.

4. To gather at as many points as possible in each country observations regarding storms, hail, and periodic phenomena relating to plants and animals; the result to be centralized, co-ordinated, and published.

5. To establish a certain number of meteorological observatories in connection with each other, the observations to be made known immediately to crop reporters, and a knowledge of them spread abroad to prevent the effects of frosts, inundations, &c.

Such a system, adopted and efficiently worked by the states and provinces of this continent, would render to the agriculturist an invaluable service.

In the Australian colonies good progress has been made. A conference of government statists, representing the colonies of Victoria, New South Wales, South Australia, and Tasmania, was held at Hobart Town in 1875, when resolutions were adopted covering the whole domain of social, industrial, commercial, and financial statistics.

The conference recommended in its report that the agricultural returns should embrace the area of land in occupation, the acreage and produce of crops, the weight of cereals and their market price, the number of hands employed and the rates of labor, the number of live stock, the number and value of agricultural implements, and the value of machine labor.

In its main features this was simply an adoption of the Victorian system. In Victoria there is an act called the local government act, which obliges all municipal bodies throughout the colony to collect such returns as the government statist, with the approval of the governor, in council, may direct, and all people are bound to give the information required to the municipal collectors under a penalty of £10. In this way the agricultural statistics are gathered without any expense to the government.

The forms are distributed to the local bodies by the official statist, and at a specified time the work of collecting begins. One schedule is filled up at each agricultural holding, and the proprietor signs his name to it as a guarantee that the collector has called on him and that the information is correct. The original returns are sent to the statist without being compiled, and they are classified in the statistical office according to the municipal districts in which they are gathered. Manufacturing returns are collected at the same time, and by the same agency.

There is no popular prejudice in the colony against giving the information, and consequently the penalty clause is seldom enforced. Every farmer has a guarantee that his schedule will not be used to his injury or discredit, for the collector is under a penalty not to divulge any information it contains, and the returns are only published in the aggregate by municipal districts.

As for the municipal bodies, they are subsidized by the government, and if they hesitate or refuse to collect the statistics the government has power to stop their subsidy. It has also power, if any local body does not send in the returns by the proper time, to appoint a collector to gather them and charge the cost to the delinquent body.

The legislature of Tasmania passed a measure for the collection of statistics in 1877, containing provisions similar to the Victoria act, and conferring like powers on the government statistician.

I need not in this convention refer to what has been accomplished in the United States. You are all familiar with the origin and progress of statistical work in connection with the Department of Agriculture since its organization twenty years ago. It is a work of great magnitude, extending over a wide aera and requiring for its proper direction a high order of executive ability. Indeed in view of its growing magnitude and importance, and no matter how ably directed, there is good reason for questioning the efficiency of the present system, as has been done in a very practical way by Illinois, Ohio, and two or three other States. It is evident that under State organization the field of inquiry can be more completely covered, and that more exact data can be collected; so that all that seems to be required now is an extension of the State movement and harmony of action between the State and national bureaus, such as we find under the new German system. In other words, you only require to develop the Federal idea in order to give your system a well rounded completeness.

A CONTINENTAL SYSTEM.

This leads me, in conclusion, to suggest the expediency of following the advice of the International Statistical Congress and organizing

what, for lack of a better term, may be called the continental system. We have already such a system in connection with the Meteorological Service; stations are established throughout the United States and Canada; there is a daily interchange of reports between the head offices at Washington and Toronto, and daily bulletins are issued based on the total of information.

Now, why may not the two countries work out a continental system of crop reports in the same way? It only needs a mutual understanding and a prompt exchange of reports to give the idea practical effect.

But it may be said that the agricultural and animal products of Canada are not sufficiently important to make a factor in the calculation of the supply and demand problem. The same thing may be said of Ohio, Michigan, or Illinois as well as of Ontario or any other Province of the Dominion. Yet it does not follow that a knowledge of the products of one or other of those States is immaterial in making a forecast of the tendency of prices. The more extended and accurate our information the more reliable will be the advice we can give; so long, at any rate, as our surplus products continue to find a common market.

Besides, the time is not far distant when Canada must become a very important factor in estimating the food supply of the world. The Northwest is just beginning to be opened up, and in a few years its farm population will be numbered by the hundred thousand. It is a prairie region of vast extent. There are at least 150,000,000 acres of wheat and barley land and 50,000,000 acres of pasture land, a territory equal in extent to the States of Ohio, Indiana, Illinois, Missouri, Iowa, and Minnesota. It is the natural habitat of spring wheat, which attains there a perfection to be found nowhere else on the continent, and its grasses are so rich that cattle and horses turned out on the plains for the winter are taken up in the spring in prime condition.

The Canadian Northwest is a country of immense capabilities, and in any well-considered scheme of agricultural statistics its products cannot be left out of the reckoning.

A DELEGATE. I move that a vote of thanks be extended to Mr. Blue for his able and valuable statement with regard to crop statistics.

The motion was unanimously agreed to.

Mr. UPDEGRAFF spoke of the importance of the work which Mr. Chamberlain was doing in the State of Ohio, and the value thereof. He referred especially to Mr. Chamberlain's prediction that wheat would be worth $1.45, when at the time it was selling at 90 cents. Mr. Updegraff then referred to the difficulty which had always attended the granting of appropriations for the benefit of agriculturists as compared with those for the benefit of certain institutions, closing by advocating the sending of petitions to Congress by farmers requesting liberal appropriations for the Department of Agriculture.

Mr. CHANEY, of Ohio, explained that his State did not ask any appropriation from Congress, nor from anywhere else for its statistical work. That it simply asked that the general government should furnish the statistics for foreign countries, which his State has no power to collect, in order that it may acquaint its farmers with the exact state of affairs, thus helping them to reap the greatest advantage and the best prices from their productions.

Mr. BRIDGER, after some explanatory remarks in relation thereto, offered the following resolutions:

In pursuance of the French order that has just been received, dated February 18 last, forbidding the landing of American salt pork in France, which order was issued fallaciously and without foundation, in

the opinion of this convention. For more than two hundred years the slaves of the South lived continuously on salt pork and corn bread, and performed an amount of labor annually that few people in this world have performed. In fact our Western empire has been opened by the men who ate more or less of the hog product from day to day: Therefore,

Resolved, That this convention petition Congress to pass a reprisal act that will forbid the landing of French wines, on the ground of adulteration, and exclude French silks on the ground that our cotton fabrics are forbidden, even under a tariff—with more than a hundred other articles of our production—whilst we receive everything produced in France under our tariff system that should be admitted into such a community as ours.

Resolved, That in our opinion every avenue of outlet for our surplus products should be most assiduously guarded. For example, France, until the last five years, was an exporter of wheat for seventeen consecutive years, and with three consecutive good crops in Europe, we may expect a decline in breadstuffs and provisions. On the basis of our present production,—therefore, the necessity of varying our crops as much as possible, and throwing a protection over our exports in every possible way, we recommend that the Secretary of the Treasury shall appoint expert inspectors of farm products at each of our important custom-houses, and upon his certificate only shall exports be made from the United States of breadstuffs and provisions especially, or such other articles as the Secretary of the Treasury may name. Said inspectors to furnish the government ample bonds, with the additional penalty of imprisonment for six months for every fraudulent certificate that may be issued.

Mr. CHAMBERLAIN. These resolutions have many points that demand more consideration than we can give them at this hurried hour, and I therefore move their reference to a committee of three, to be appointed by the chair, to be reported at some future time to this convention.

The motion was agreed to, and the following committee was appointed: Messrs. Chamberlain, Fisher, and Heron.

The president announced the papers for to-morrow, and then at 5.17 p. m., the convention adjourned until to-morrow at 10 o'clock a. m.

The convention was called to order at 11.10 a. m., Tuesday, January 17, and Mr. Sargent, of California, read the following paper:

VITICULTURE IN CALIFORNIA.

By A. A. SARGENT.

Mr. PRESIDENT: My esteemed friend, Hon. H. F. Page, of California, recently received a telegram from the president of the California Viticultural Society of his State, requesting him to lay before this body certain statistics concerning the important industry in which that society is engaged. As my friend is deeply engrossed in Congressional duties, he could ill spare the time to put those statistics in methodical form, or attend this convention. Last evening, therefore, he requested me to take this duty off his hands. To this I consented, well knowing, however, that I had not the time or data to do justice to the subject. There are some general facts and suggestions which I will submit upon the subject.

California extends along the Pacific coast seven hundred and fifty miles, with an average breadth of two hundred and thirty. Its area is 188,981 square miles. It is estimated to contain eighty-nine millions of acres capable of cultivation. To use a comparison, its agricultural area exceeds that of Great Britain and Ireland, or the entire peninsula of Italy. The soil and climate of the State are adapted to the growth of

wheat, barley, oats, potatoes, hops, tobacco, hay, and sorghum; to corn, cotton, and sugar-cane; to every variety of garden vegetable cultivated east of the Rocky Mountains; to the apple, peach, pear, cherry, plum, apricot, nectarine, quince, fig, and grape; and along the southern coast the orange, lemon, citron, olive, pomegranate, filbert, walnut, almond, prune, pineapple, banana, cocoanut, and plantain. The strawberry is picked every month in the year, and all berries grow in abundance. The climate is free from severe frosts, cold, or storms. The tornadoes that trample through other portions of the country are unknown there. The climate is favorable to stock-raising, and sheep husbandry is an important interest. "The north side of a rail-fence" has no terrors or mischiefs for cattle, even in winter. The farmer needs no great barns or granaries to store his harvest; but leaves his wheat in sacks in the field until it can be conveniently removed for a market. With a variety of productions unexcelled on any equal area, a climate unsurpassed in beauty and salubrity, and a soil seemingly inexhaustible, it is easy to predict for the agriculturists of the State the highest prosperity and comfort.

Such is agricultural California as it is seen to-day. Thirty years ago it was looked upon as a hopelessly barren wilderness. The original idea entertained of California was that some parts of it might be fit for grazing; but it was considered as generally unadapted to agriculture. Mr. Webster, in a speech which made a sensation at the time, gave as a reason why the Wilmot proviso need not be extended to the territory out of which the State was subsequently formed, that slavery could never exist upon such barren soil; that nature had erected a more formidable barrier than legislation could devise. When gold was discovered at Sutter's Mill and found to glitter among the grass roots of the mountains, a vast population poured into the State by the weary plains, the long route around Cape Horn, and the sickly isthmus; but of all those moving columns of humanity, instinct with young life, enterprise, and hope, none dreamed of riches of soil of the golden State; none knew that the yellow harvests that would by and by beautify the State could be a possibility, or dreamed that the farmer's plow would turn up treasures far surpassing those developed by the miner's spade and pick.

It was early discovered that the wide plains over which listless cattle had roamed at will would respond to cultivation; and wheat production in time rivaled that of gold and silver. Then fruit trees and vines began to be cultivated, and nature laughed as it handed back abundant and luscious returns. The barren foot-hills, as they were called, needed only an invitation to show their capacities, especially for the vine. The yield of grapes were found to be almost phenomenal, wherever the vine was planted, from the Mexican border to Mount Shasta. No trellises were needed. The vine could sprawl upon the ground and never mildew. Leaf diseases were unknown. There were no unfavorable seasons; all soils seemed congenial. Few insects disturbed the vine or fruit, and phyloxera is to this day of slight moment.

With such abundance and perfection of raw material, the attention of the pioneers was at once turned to wine making. Rude wine presses were improvised, and everywhere there was anxiety to learn how to raise the raw products to the dignity and desirability of a marketable commodity. The results of the first experiments were certainly crude. Even the patriotic Californian, who is said to attest to the perfection of everything emanating from his State, was compelled to admit that unquestioned purity of materials could not compensate for equally unquestionable harshness—let us say fiery acidity. The soil was too generous. The burden of alcohol was too great, even to imitate the fruity wines of Spain and Italy not to mention the thin wines of France and Germany. Then the workers lack experience, and knowledge, and machinery, and method. In the expressive language of the prize-ring, California wine "got a black eye." It was the thing even in California to decry it; and elsewhere it was used only to give body to some detestable thin wines of doubtful parentage, which were then sold under foreign names. Wine making in California passed through all the phases that beset most new industries, where the promoters have zeal and perseverance and little knowledge. Those processes are familiar to you, and I need not dwell on them. Suffice it to say that many men abandoned the field, plowed up their vines, and turned their vineyards to more appreciated uses. But there were others who persevered. They imported the best varieties of vines; they experimented in modes of culture; in the effect of different soils; in results from selected grapes and in the mixtures of various kinds; they induced experienced workmen of France and Germany to come over, to apply the methods of those countries, and by enlightened and costly efforts all directed to the solution of their great problem, they have at last conquered the difficulties that arose from natural conditions and inexperience, and are even fast overcoming the still greater obstacles interposed by prejudice and skepticism.

The number of acres in California producing vines is over 50,000. But so great has been recent stimulus to the business that there have been planted within a twelve-month 50,000 acres more, which will bear in four years. The acreage bids fair to increase immensely every year. The vineyardist finds as ready sale for his grapes, if he does not wish to turn them into wine, as the farmer does for his wheat, and at more

remunerative prices per acre. The last vintage was over 9,000,000 gallons. The present value of the wine crop to producers is $3,000,000. That of table brandy and raisin grapes is $1,500,000. The world does not produce anywhere finer raisins than those of Fresno County, where once arid lands have been irrigated and subjected to raisin-grape culture.

The government collects annually from California brandy $800,000. The figures show the importance of this interest even in its comparative infancy. The possibilities for expansion are immeasurable. The viticulturists of California deem it reasonable that a part of the sum collected on their domestic product should be expended for experimental vintage in that State, where climatic conditions are peculiar. The government would undoubtedly render a vast service to this promising industry if it would set aside a part of the produce of this tax to conduct experiments upon the unsolved questions in connection with it. There is no field in the range of agricultural science that promises better returns.

The world has noticed with concern the ravages of the phyloxera in France. Great estates, once valuable for their rich vineyards, have been devastated as by a prairie fire. The desolation has been widespread, baffling the corrections attempted by science until the production of wine has been greatly lessened, and the gloomiest forebodings are felt for the future of this great industry in that country.

At this juncture, California steps forward as the France of America. Its capacity is unlimited, and its wines are approaching the excellence of its typical namesake. Its soil and climate will answer any demand on their resources; discipline is taming the fiery spirit of its wines, and uniting to their acknowledged purity the delicacy and subtleness of the best foreign productions. Hence, certain California wines are already beginning to make a reputation under their own brands, and are readily sold as such in home and Eastern markets, while a vast quantity of our wine is sent to the Eastern States, and there sold under foreign labels. It is estimated that California is now sending to the Atlantic States more wine than is imported from France. I venture to suggest that it would be better for the health of your people if it should exclude French wines entirely from the market.

In California the cheapest element that can enter into wine-making is the juice of the grape. Adulteration is comparatively costly. There is no temptation to use even beet juice; and logwood, and the long list of drugs and chemicals that a Bordeaux laboratory is furnished with, since grape production is beginning to become a tradition in France, would be too expensive to compete with the gushing juice of the wine-press in California. It is understood that the sophistication of wine is a regular trade in several of the seaports of France, which is carried on to a vast extent. Severe laws prohibit the sale of the infernal products in France; but their manufacture for export is not interfered with. The remainder of the world may be poisoned, but not France. This is a very proper measure for the protection of its own people by the authorities of that republic; but we may well take warning from it. The adulterators use any corks or labels that they please, and flood all civilization with detestable compounds that produce dropsies and Bright's disease and dyspepsia, and numerous other ills, that flesh loves not to be heir to. Against such villainous compounds, I put our pure California wines, our port and claret, as fine wines for domestic use as any imported from France, and incomparably superior to the mass of stuff sold as French wines. Our sparkling wines and our brandies are coming in for commendation by connoisseurs. I do not mention brands, because it is apart from my subject, which is merely to call attention to an interesting general industry. Large quantities of our port and claret are sold to you under foreign labels. You are fortunate that nothing is charged besides the label. Port that experts could hardly distinguish from old London dock, comes from our presses, and clarets equal to the old Chateau Lafitte has the same parentage.

It has always seemed strange to me that our people will more readily buy an article with a foreign name than as good, or one better, under a domestic name. In such matters we have not yet entirely achieved our independence. We have answered the sneer, "Who reads an American book?" And our historians, novelists and poets have forced the world's admiration. Our inventions won applause at the world's fairs of London, Paris, and Vienna. It is yet asked, "Who drinks an American wine?" But it is more feebly asked than formerly. California is working the miracle of converting the world from skepticism in this regard, and adding another to the great productive industries of the country.

The following papers and tables were submitted to accompany the foregoing essay:

[State Viticultural Commission, San Francisco district. Arpad Haraszthy, commissioner. Address, 530 Washington street, San Francisco, Cal.]

Hon. H. F. PAGE, Esq., *Washington, D. C.:*

DEAR SIR: I beg to inclose the documents on the analysis of foreign wines in the bonded warehouses of the United States at this ports. A circular was sent from the

Secretary of the Treasury to all the collectors of ports, requiring them to make reports upon the wines in bond, from whence imported, their qualities, their original and invoice prices, and have an analysis made of their various alcoholic strengths. Ex-collector Thomas Shannon requested me to assist him in the matter, and as no funds were furnished him for the analysis by the Treasury Department, that expense was assumed by the State Vinicultural Society, and the services of Dr. John I. Bleasdale were engaged for the purpose. Mr. Thomas Shannon made a complete and very lengthy report, which was forwarded to the Secretary of the Treasury. * * * I now wish to draw your attention to a few points comprised in the subjoined tables.

Clarets.—The *original* natural average alcoholic strength of the ordinary shipping clarets of France are under 10 per cent., and it can safely be estimated that all wines of ordinary character, showing more than 10 per cent. in these tables, have been fortified with extraneous alcohol. Turning to the tables we find of 54 samples only 11 that are under 10 per cent., and 43 samples over 10 per cent.; showing that all of the 43 samples had been fortified more or less. Some were fortified only 10 per cent. over their original strength, while others varied in this fortification from 20 even to 50 per cent. over their original natural strength; and one sample, the first on the tables, was fortified up to 27½ per cent., or nearly 170 per cent. over the assumed natural strength.

This wine was an unlawful wine, as the custom-house regulations do not permit of any importations of wine over 22 per cent. of alcohol, and it should have been seized by the United States authorities. How much of this kind of business has been carried on by the importers cannot now be told, but the government must have been defrauded of very great amounts by such means, for it does not levy duty, as it ought to, according to the alcoholic strength over and above the original natural strength.

Port wines.—From Mr. J. B. Keene's reports to the British Government it seems that the natural average strength of unfortified port wines is 13½ per cent. absolute alcohol. Yet, of all the forty samples analyzed by Dr. Bleasdale, the lowest sample showed 17.115 per cent. of alcohol, and the average of all the samples showed 19.324, which plainly indicates an addition of quite 6 per cent. of distilled spirits, from which the United States Government has derived no revenue. And three of the samples contained an illegal strength, being over 22 per cent. in alcoholic strength. These three samples should have been confiscated to the government.

Sherry wines.—Mr. J. B. Keene has placed the natural alcoholic strength of sherry wines at 17.412 per cent. absolute, but I am much inclined to believe that Mr. Keene has been imposed upon in the samples sent him, and that no wines of the Xeres district ever go over 16 per cent. absolute alcohol by their own fermentation, nor do I believe they ever reach 16 per cent. Still, even if we adopt Mr. Keene's figure of 17.412, there is yet an average addition of 3 per cent. of distilled alcohol of the 48 samples reported upon by Dr. Bleasdale, who has found an average strength of 20.406 for the 48 samples analyzed by him. Of these samples 9 should have been seized by the government, being over 22 per cent. in alcoholic strength. And thus has the United States Government been quietly defrauded of its revenues for years in every port of entry in the Union. The simple fact of the case is that the United States citizen is called upon to pay a tax upon the spirits required by him for the manufacture of angelica, muscat, port, and sherry wines, while the importer has no such tax to pay, and therefore has the advantage over our native producers of that class of wines. The only remedy is to place a specific duty on all natural wines that do not contain over 11 per cent. of alcohol (say 40 cents per gallon, the present duty), and on all wines over 11 per cent. so much for each per cent. over that amount of alcoholic strength. I would suggest 2½ cents for every degree of absolute alcohol over and above 11 per cent., in addition to the 40 cents already levied. I would suggest that every invoice be tested for its strength (it would require but ten minutes to do it accurately), and that if any wines be found to contain more than 22 per cent. of absolute alcohol that they be immediately seized by the United States collector of customs and forfeited to the government.

Not wishing to trespass more upon your very valuable time, I will close with the hope that you will be able to use the inclosed documents in full, as they will be very valuable for future reference and future legislation.

* * * * * * *

With very respectful regards, believe me truly yours,

ARPAD HARASZTHY,
President State Board of Viticullure.

REPORT ON ANALYSIS OF FOREIGN WINES IN UNITED STATES BONDED WAREHOUSES AT SAN FRANCISCO.

[Made for the California State Vinicultural Society by John I. Bleasdale, D. D.]

A report upon and statements of analysis of foreign port, sherry, and claret wines lying in bulk in the bonded warehouses of San Francisco, Cal., between December 10, 1879, and April 15, 1880, collected under authority from the Secretary of the Treasury, Washington, for the purpose of being analyzed by Rev. John I. Bleasdale, D. D., F. G. S., &c.

I have the honor to submit the following report upon 40 samples of port wines, 48 of sherry, and 54 of clarets, collected by myself in the bonded warehouses of this city, in accordance with instructions conveyed in the following communication from Arpad Haraszthy, esq., president of the State Vinicultural Society:

"JOHN I. BLEASDALE, D. D., *&c.*:

"I inclose authority from the Secretary of the Treasury, to collect foreign wines now in bond. Get a number of the average samples of the larger and usual importations of ordinary and low-grade prices of port, sherry, and claret; port from Portugal, or England, or France; sherry from France, Spain, or England; claret or red wines from wherever shipped. Get enough samples for a complete test. Find amount of absolute alcohol of each sample, approximate amount probably added, making deductions from the *normal* amount usually produced naturally in each section. Find amount of tannin, free acid, and combined acid. Make the report as concise as the subject will permit.

"ARPAD HARASZTHY."

Accompanying the letter were permits to deliver samples addressed to the several keepers of bonded stores, as under—

"Storekeeper at ——— will deliver to bearer the following samples of wine, viz: One pint of any he may select for analysis.

"E. G. WAITE, *Naval Officer.*

"By order of the Secretary of the Treasury.

"J. McNULTY, *Collector.*"

All of the samples were drawn out of casks, and each one represents a parcel consisting of a number of casks of the same brand and shipment. It is rather to be regretted that no bottled samples were directed to be analyzed, as it would have been instructive to have compared them, and so shown fully the characters of all, especially that of the French clarets; because the aim of the makers of red wines in this State is directed, for the most part, to the production of wines of the claret character.

With regard to the processes of analysis, I would remark that, as two or more days are required to complete some of them, and as the government did not allow sufficient samples; there appeared to be no other course open, after a preliminary examination, than to separate the best and worst, in respect of free and combined acids and tannin, from the middling, in which little or nothing characteristic was discovered. Light wines of low alcoholic strength, such as the clarets, are very liable to undergo change after a bottle, especially a small one, has been opened two or three times, and to form acetic acid, or become moldy, which would vitiate the results afterward obtained.

There was found a very considerable quantity of sulphuric acid in both the ports and sherries, which was determined in each separate sample as sulphuric anhydrite. The tannin (tannin acid) was determined as tannate of lead, according to Wittstein's formula; and lastly the total organic acids, free and combined, as tartaric, on Delaprè's formula, by multiplying the number of cubic centimeters of decinormal soda used to neutralize the acids in 20 cubic centimeters of the wine by 0.0375.

The greater part of the samples were distilled oftener than once, in which case, the decimals represent the means.

The *decimals* showing the weight by *balance* of the alcohol in the wine are given for the use of any one who may wish to check the calculations deduced from them, which, though near enough, may possibly have in an instance or two fallen short of absolute accuracy.

From the decimals the spirit strength is recorded, 1st, according to tables of British standard proof (Sykes' hydrometer), as recently revised by Mr. J. B. Keene, of the distillation department of customs, London, considered to be the most reliable, as well as the most simple and easy, from which to calculate the amount of absolute alcohol. The alcoholic strength of the wines is given in volume per cent. of proof spirit.

By measure in mixtures of alcohol and water, the alcohol forms the larger portion in the inverse ratio of its specific gravity; and if equal quantities by measure of alcohol and distilled water be taken and mixed, the united bulk will prove less than when separate by 3°.74 per cent. So the calulations are based upon the value of alcohol in proof degrees.

My attention had been specially directed to the the French clarets. The general average strength found from the samples was, as British-proof, 20.0105—as alcohol, 11.4345.

As already mentioned, the tannic acid was determined as tannate of lead, giving as the average of 10 samples of the best, 0.448 per cent; while 10 of the most inferior 0.325 per cent.

	Per cent.
The ten best averaged volatile free acid	0.128 as acetic.
The ten best averaged fixed and combined	0.4513 as tartaric.
Total	0.5793

	Per cent.
The ten worst gave free acid	0.2021
The ten worst gave fixed and combined	0.4820
Total	0.6841

Artificial coloring matters were songht for, especially such as the juice of huckleberry, but not found; neither was logwood. Brazil-wood, nor beet-root coloring, nor fuchsine, nor acetate of lead. The color was all of vegetable origin. When fresh from the cask it was very deep purple, no sample showing the characteristic Burgnndy red, and excepting a few of the best, notably those branded AV., were a general average of so-called ordinary Bordeaux wines. Besides the 54 separate samples, a few others were partially analyzed in search for artificial coloring; but they are not reported upon, as they had evidently been fortified, and belonged to what are sometimes called "doctors"—meant to raise the strength and body of poorer kinds.

The average spirit strength of those not perceptibly fortified was British standard proof, 19.4077 alcohol=11.409

The highest strength was 27.20=15.520.

The lowest strength was 15.40=8.787.

Number of samples above the average, 27; number samples below the average, 26; total, 53.

One sample was fortified as highly as 48.2 British-proof, or alcohol, 27.540. It appears in the first line of the analysis, but was rejected when computing the general average strength of the samples.

The Port wines.—Of the port wines collected, 40 samples were selected for analysis, as fairly representing the characters of the rest, 49 in number. With four exceptions all had the appearance of being ripe old wines, having either deposited naturally much of their original coloring matter, or been deprived of it by the nature of the finings put into them. They were smooth on the palate, moderately free from sugar, and holding much less tannin than is usually found in good samples of London Dock port. Taken one with another, they were fair samples of what at present is known as Oporto wines. They had been heavily sulphured, some of them excessively. The method necessitated by the smallness of the quantity allowed by the government was, after a preliminary examination, to take equal measures of ten samples and mix them together in a bottle, and analyze. Ten samples yielded an average of 0.7939 per 1.000 sulphuric anhydride.

	Per cent.
Average of tannin in ten of the best	0.0243
Free volatile acids computed as acetic	0.1680
Fixed and combined computed as tartaric	0.4370
Sulphuric anhydride	0.00793
	0.63723

Regarding the important point of added alcohol, I found much difficulty in obtaining a fair average of the natural strength of real port—the pure wine of the Alto Douro. For this purpose I examined carefully the official reports of the royal commissioners for the wines and vineyards of Portugal, 1867 and 1868, and found that the highest strength attained in natural port of the Alto Douro was made in the hottest locality and most highly cultivated vineyard of Traz-os-montes. I translate the following parapraph:

"There are localities on the Douro, as are nearly all those where the vineyards are situated on the right bank of the river, between the Pinhao and the Tua, in which the greater part of the good kinds of vines produce musts which will mark on the glucometer 20° of sugar, in ordinary years; that is to say, 30 kilograms of sugar to the hectoliter. In other localities the mean degree of sugar does not exceed 15°, and there are situations where the musts do not reach 15°."

The Portuguese commissioners evidently use Beaume's hydrometer, and, as hardly two of them made by different makers agree, there may be considerable errors in the strengths stated, though not sufficient to vitiate the figures for practical purposes. And, again, if there be errors in the indication of sugar in the musts, the errors are constant for the same instrument.

After calculating a great number of spirit strengths recorded in these reports, either as alcohol, weight of sugar, or in degrees of the glucometer, I arrived at the average which I have adopted in this report, viz., 15.5 alcohol = 27.163 British proof. The approximate quantities of added alcohol was originally computed at that strength; but shortly before the analyses were completed, I became aware that Mr. J. B. Keene, of Her Majesty's customs, London, had been engaged upon the distillation of the wines of Portugal and Spain, and on application being made he kindly sent me a copy of his reports. The number of samples obtained by Mr. Keene from Traz-os-montes, districts of Villa-Real and Bragansa, was 41, and the average strength as British-proof, 23.602 = alcohol 13.467.

There being about 1 per cent. difference between the alcoholic strength obtained by him and that deduced by me from the commissioners' reports, 14.265 = 25, British-proof, I adhered to my own estimate, because some of the foreign ports come from countries where the average amount of alcohol in the natural wine rules higher than that found by Mr. Keene in samples from Traz-os-montes. His determinations of strengths of European wines, especially those of Spain and Portugal, of which these are, Spanish, 554, and Portuguese, 457 samples, are very interesting to Californian viniculturists, as they supply standards of strength when not fortified. As an appendix to this report I have made an abstract of his tables for that purpose.

Considering the large quantities of port and sherry already manufactured from our native wines, and the ready and increasing demand for them, the calculations I have made place in clear light the disadvantage at which the California wine maker is placed who has to pay to the United States revenue-tax on the alcohol he must needs use for fortifying, while the foreigner can use alcohol at discretion without tax. Now, the 40 from the bonded warehouses yielded an average of 33.817 British-proof = alcohol 19.324—the amount of proof spirit added being 10.215 per cent., if we take Mr. Keene's results.

Port wine is manufactured in the California wine districts where malvasie and zinfandel, taken together, average less than 13.5 alcohol, and sherry where the strength hardly reach 14. of alcohol. But to compete with the foreign they require necessarily to be highly fortified.

Sherry wines.—Number of samples specially analyzed, 48; highest strength British-proof, 40.995 = alcohol, 23.425 per cent.; lowest strength British-proof, 29.400 = alcohol, 16.800 per cent.; number of samples above average, 22; number of samples below average, 26; general average of the 48 samples, 35.710 = alcohol, 20.406 per cent.; tannic acid, 0.210 per cent.; sulphuric acid, free and combined, ten worst samples, 1.600 per 1,000; sulphuric acid free and combined, ten of the best samples, 0.891 per 1,000.

An average of 25 samples gave for other acids, computed as tartaric, 0.376 per cent

N. B.—In 1874-'75, Mr. J. B. Keene determined 30 samples of sherry wine as follows Number of samples, 30; highest strength British-proof, 40.30; lowest strength British-proof, 27.50; above average, 14; below average, 16.

JOHN I. BLEASDALE, D. D.,
613 Merchant street, San Francisco, Cal.

Analysis of claret wines obtained from bonded warehouses at San Francisco, Cal.

Name of bonded warehouse.	Name of the ship.	Brands and marks.	Strength indicated by balance, specific gravity at 60° F.	Strength as British proof by Sykes's hydrometer.	Absolute alcohol in same.	Remarks.
				Per cent.	*Per cent.*	
Battery	Alpo Zeli	S & C	.97580	48.200	27.542	
	Bengale	D B	.98036	27.200	15.520	This sample was evidently sent in order to fortify poorer wine, and is not computed in estimating the general average strength. It serves to show how highly wines are fortified sometimes.
Gibbs	do	T R	.98066	26.600	15.049	
	Do	T R	.98246	24.250	13.837	
	Do	P & F	.98272	23.300	13.295	
Pacific	do	A V	.98492	20.200	11.526	
Danforth's	Buenos Ayres	W & B	.983575	22.050	12.582	
Battery	Callotta	A D S	.98644	18.500	10.612	
Danforth's	Delphine Melanie	F C R	.98256	22.500	12.838	
Battery	do	S	.98550	19.250	10.984	
	Do	J L	.98620	18.000	10.285	
	Do	A S & C / H S & C	.98559	19.249	10.984	Tannic acid average of 20 samples gave 0.44865 per cent. and 21 others, 0.3440 per cent.
	Do	P D & C	.98716	16.490	9.409	
	Do	P M	.98736	16.300	9.300	
	Do	H S & C	.98312	22.950	13.095	
	Do	E S F	.98480	19.900	11.355	
Gibbs	do	[illegible]	.98800	15.400	8.787	Acid free and combined computed as tartaric.
Battery	Equator	H S & C	.98118	25.550	14.579	
	Do	F C K	.98112	25.300	14.721	
	Do	P D A	.98516	19.570	11.166	20 samples average 0.5691.
	Do	P D C / F	.98428	20.800	11.868	18 others average 0.6302.
	Do	S	.98516	19.600	11.148	
	Do	B & C	.98509	19.909	11.212	
	Do	A S & C / H S & C	.98524	19.250	10.984	
	Do	H S & C	.98520	19.250	10.984	
	Do	P D & C	.98440	22.100	12.510	
	Do	J L	.98567	18.600	10.613	
	Do	P D	.98550	19.250	10.984	
	Do	J L	.98636	17.740	10.010	
Gibbs	do	F P	.98373	21.700	12.382	
	Do	J S / M	.98793	16.080	9.175	
	Do	Q	.98772	15.740	8.981	
	Do	J D / F P	.98392	21.520	12.266	
	Do	F P	.98477	20.600	11.754	
	Do	J S / B	.98480	16.800	9.586	
Pacific	do	J L	.98520	19.250	10.987	
	Guayaquil	P F E	.98716	16.800	9.586	
	Do	A V	.98600	17.000	9.700	
Danforth's	Maipu	$\frac{147}{162}$	.98477	20.200	11.540	
Pacific	do	A V	.98486	20.150	11.497	
	Do	A V	.98304	22.950	13.095	
	Do	J C	.98512	18.200	10.442	
	Do	A V	.98512	18.300	10.442	
	Do	P G S	.98604	18.090	10.271	
Battery	do	P D & C / N B	.98568	19.000	10.841	
Danforth's	Quillotta	J P	.98658	17.400	9.928	
	Do	R T	.98337	22.350	12.753	
	Do	A V	.98658	17.400	9.928	
Pacific	do	Hand	.98491	20.100	11.469	
	Do	A V / H	.98566	18.900	10.784	
	Do	A V	.98284	23.300	13.295	
	Do	W R	.98312	22.500	12.830	
	Do	A V	.98512	19.900	11.355	
Danforth's	Guayaquil	A V	.98683	16.800	9.558	

JOHN J. BLEASDALE, D. D.,
Organic Chemist.

Analyses of port wines obtained from bonded warehouses at San Francisco, Cal.

Name of bonded warehouse.	Name of the ship.	Brands and marks.	Strength indicated by balance. (Specific gravity at 60° F.)	Strength as British proof by Sykes's hydrometer.	Absolute alcohol in same.	By taking the original wine at 25 degrees, British proof, the proof spirit added has been—
				Per cent.	*Per cent.*	*Per cent.*
Gibbs's	A. C. Defredus	BFR	.97616	34.000	19.400	9.000
	Beecroft	5 to 12	.97725	31.900	18.700	6.900
Pacific	do	F&C	.97376	37.950	21.654	12.950
	Do	F&C	.97534	35.200	20.085	10.200
	Bengale	A V	.97704	31.150	17.774	6.150
Gibbs's	British Nation	D	.97573	34.550	19.714	9.550
	British Army		.97544	34.200	19.515	9.200
Pacific	British Consul		.975440	35.200	21.369	10.200
Danforth's	Bruce		.97646	33.498	19.114	8.498
Gibbs's	Cape Clear		.97496	35.850	20.456	10.850
	Charles Cotesworth	L & C	.97728	31.802	18.147	6.802
	Do		.97805	30.880	17.620	2.145
	Do	L & C	.97712	32.100	18.701	7.000
Danforth's	do		.97726	31.998	18.258	6.998
	Do	4/s	.97727	32.098	18.215	7.098
	Do	B	.97701	32.798	18.714	7.798
	Do		.975658	34.898	19.910	9.898
	Do		.97586	34.550	19.714	9.550
Gibbs's	City of Amoy		.97488	36.280	20.701	11.280
	Do		.97686	32.800	18.716	7.800
	Do		.97821	30.450	17.374	5.450
Pacific	City of Bernares		.97592	34.520	19.697	9.520
Gibbs's	City of Vienna		.97684	33.150	18.915	8.150
	Do	S	.97542	34.200	19.515	9.200
Pacific	Corolla	S	.97433	37.250	21.255	12.250
Gibbs's	Dunnerdale	S	.97133	42.600	24.308	17.600
	Do	S	.97396	37.950	21.654	12.950

Analyses of port wines, &c.—Continued.

Name of bonded warehouse.	Name of the ship.	Brands and marks.	Strength indicated by balance. (Specific gravity at 60° F.)	Strength as British proof by Sykes's hydrometer.	Absolute alcohol in same.	By taking the original wine at 25 degrees, British proof, the proof spirit added has been—
				Per cent.	*Per cent.*	*Per cent.*
Pacific	Eskdale		.97408	37.500	21.398	12.050
Danforth's	Galatea		.97344	38.640	22.048	13.640
	George Bewley		.97324	39.023	22.694	14.023
Gibbs's	Jena	CM	.97740	31.150	17.774	6.150
Battery	Marie	P D & C	.97651	33.891	19.338	3.866
	Do	P D & C F D	.97426	37.302	21.284	5.813
	Do	P D & C	.97580	34.611	19.748	4.277
Gibbs's	Oakworth	CM	.97636	33.150	18.912	8.150
	Pizarro		.97484	36.550	20.870	11.550
	Strathspey	NM	.97868=mean & .97849	34.599	19.741	9.599
	Tynca	CM	.97840	30.450	17.374	5.450
	Victoria Nyanza		.97579	34.804	19.859	9.804
Battery	Valentine	P D & C dragon	.97813	30.009	17.115	1.642

Analyses of sherry wines obtained from bonded warehouses at San Francisco, Cal.

Name of bonded warehouse.	Name of the ship.	Brands and marks.	Strength indicated by balance, specific gravity at 60° F.	Strength as British proof by Sykes's hydrometer.	Absolute alcohol in same.	Estimated alcohol added.	Supposing the original wine to have had 23 per cent. of proof spirit, then the quantity of proof spirit required would be—	Remarks.
				P'r ct.	*P'r ct*	*P'r ct.*	*P'r ct.*	
Danforth's	Abernyte	P	.973650	38.298	21.853	8.729	20.376	Acids free: Tartaric and others computed as tartaric, 0.376 per cent. of 25 samples; anhydrous sulphuric, 25 samples, gave per 1,000, 1.601; 10 others, 0.891 per 1,000 The amount of tannic acid was very little indeed.
	Do	⊗	.943685	31.300	17.802	4.740	8.300	
	Do	JHC	.973449	38.599	22.025	8.901	13.599	
	Do	H	.977500	31.150	17.774	4.650	8.150	
	Do	JHC B	.976270	33.850	19.315	6.191	10.850	
	Do	H	.977500	31.800	18.145	5.070	8.800	
Gibbs's	do	E DGC S	.974560	36.550	20.857	7.730	13.550	
Danforth's.	B. Reiz	BL	.978060	30.800	17.574	4.450	7.800	
Pacific	Beecroft	W F	.973630	38.200	21.797	8.673	15.200	
Gibbs's	Blinfell	H&D	.978300	31.150	17.774	4.650	8.150	
	British Nation	A DGC S	.974440	36.850	21.027	7.888	13.850	
Danforth's.	Campadre	Amontillado.	.975658	35.300	20.142	7.010	12.300	
	Centaur	△	.973049	39.299	22.417	9.300	16.299	
Gibbs's	do	U DGC S I	.973560	38.650	22.025	8.970	15.650	
	Do	DGC S	.973960	37.950	21.654	8.530	14.950	
	Charles Cotesworth.	CD№4	.975000	35.850	20.456	7.475	12.850	
Danforth's.	do	Ex super.	.975720	34.800	19.857	6.740	11.800	
	Do	do.	.975670	34.550	19.714	6.590	11.550	
	Cormorant	H H	.973650	38.279	21.832	8.718	15.279	
	Craigmiller	H	.972839	38.998	22.252	9.128	15.998	
	Do	⊗	.975990	35.200	20.087	6.968	12.200	
	Do	H	.975070	35.750	20.395	7.275	12.750	
	Do	⊗	.976560	33.400	19.058	5.934	10.400	
	Dunderdale	SE C	.974540	36.800	20.998	7.873	13.800	
	George Bewley	◇◇◇◇◇	.975156	39.005	22.270	9.114	16.005	
	Do	SS&G	.975256	35.443	20.238	7.100	12.443	

Analyses of sherry wines, &c.—Continued.

Name of bonded warehouse.	Name of the ship.	Brands and marks.	Strength indicated by balance, specific gravity at 60° F.	Strength as British proof by Sykes's hydrometer.	Absolute alcohol in same.	Estimated alcohol added.	Supposing the original wine to have had 23 per cent. of proof spirit, then the quantity of proof spirit required would be—	Remarks.
				P'r ct.	*P'r ct.*	*P'r ct.*	*P'r ct.*	
	Do		.974050	37.500	21.398	8.273	14.500	
	Do	80/100	.975900	34.100	19.456	6.340	11.100	
	Do	VHC	.975864	31.510	19.691	6.567	11.510	
Gibbs's	....do	VP	.975360	35.200	20.085	6.961	12.200	
	Do	DG&C S	.974240	37.250	21.226	8.131	14.250	
	Do	SE C	.974690	36.550	20.855	7.731	13.550	
	Do	P	.975560	35.200	20.008	6.961	12.200	
	Do	AHWA	.977600	31.600	18.031	5.455	9.600	
Danforth's	Golden Gate	BP	.973049	39.299	22.417	9.300	16.299	
	Margaret Trimble	P	.875435	35.400	20.199	7.007	12.400	
Gibbs's	....do	B Seco	.978910	20.400	16.774	3.561	6.400	
forth's.	Nelson		.972849	39.744	22.678	9.554	16.774	
	Do	B	.976700	33.000	18.831	5.706	10.00	
Gibbs's	Oriflamme		.976140	34.100	19.457	6.333	11.100	
	Patterdale		.973160	39.350	22.453	9.329	16.350	
Danforth's.	Staffordshire	Super.	.972849	39.800	22.710	9.586	16.800	
	Vancouver	SS	.972040	40.995	23.339	10.271	17.995	
Gibbs's	....do	DP PEE G	.975500	35.200	20.085	6.961	12.200	
	Vale of Nith		.973690	38.000	21.683	8.559	15.000	
Danforth's.	Vernon	Fino	.975477	35.200	20.008	6.975	12.200	
	Do		.975880	34.550	19.714	6.590	11.550	
	Grasmere	H	.977200	32.450	18.716	5.392	9.450	

JOHN J. BLESSDALE, D. D.,
Organic Chemist.

APPENDIX 1.—*General abstract of averages of the wines of Portugal.*

[Abstracted from the official report of Mr. J. B. Keene, head of the distillation department of Her Majesty's customs, London, 1875, presented to the commissioners of customs, and checked; and the alcoholic strengths computed by John I. Bleasdale, D. D., Organic Chemist.]

Province.	Red.	White.	Totals.	Highest strength.	Lowest strength.	Above average.	Below average.	Average.	Alcohol.
Algarve	18	.....	.....	30.500	24.000	8	10	26.66	15.2111
	.....	2	20	26.900	26.000	1	1	26.45	15.0927
Alemtejo	32	.....	.....	30.100	24.200	9	11	26.64	15.2110
	.....	20	.....	32.500	21.900	7	13	24.93	14.2250
	.....	.....	52	32.500	21.900	22	30	25.69	14.6590
Beira	117	.....	.....	38.800	11.700	66	51	24.91	14.2139
	.....	12	.....	32.900	22.500	4	8	26.57	15.1610
	.....	.....	129	38.800	11.700	74	55	25.07	14.3052
Minho	12	.....	12	20.000	14.200	6	6	17.38	9.0927
Entre Minho e Douro	7	.....	7	18.000	12.300	3	4	15.20	8.6733
Estremadura	119	.....	.....	40.000	20.000	43	76	25.77	14.7047
	.....	44	.....	50.000	23.000	18	26	29.10	16.6048
	.....	.....	163	50.000	20.000	60	103	26.72	15.2467
Traz os Montes	38	.....	.....	37.500	19.000	18	20	23.46	13.3875
	.....	3	.....	29.800	23.800	1	2	25.10	14.1797
	.....	.....	41	37.500	19.000	18	23	23.62	13.4650
Madeira	.....	4	4	37.800	31.300	1	3	33.45	19.0870
Sundry	2	.....	2	26.200	25.000	1	1	25.60	14.6077

ABSTRACT OF THE ABOVE.

Natural wines	318	.....	.....	31.200	11.700	167	151	24.02	.....
	.....	63	.....	31.300	22.500	29	34	25.53	.....
Fortified wines	25	.....	.....	40.000	28.400	11	14	34.600	.....
	.....	24	.....	50.000	27.000	8	16	33.990	.....
	.....	.....	49	50.000	27.000	22	27	34.300	.....

REMARKS.—These investigations prove the spirit strength at British proof of 318 samples of natural red wines of Portugal supplied by the Portuguese Government to the Government of Great Britain, to be, as British proof, 24 02 per cent., or the same computed as alcohol, 13.7061, and 63 samples of natural white wine, to be British proof, 25.53, as alcohol, 14.5677 per cent.

Fortified red wines, 25 samples: Average at British proof, 34.60; average as alcohol, 19.4372 per cent.

Fortified white, 24 samples: British proof, 33.9900; as alcohol, 19.3951 per cent.

APPENDIX 2.—*Average strength of French red wines procured from thirty departments and determined by J. B. Keene, esq., of Her Majesty's customs, London.*

Department—	
De l'Aude	25.900
Var	22.100
Gard	26.800
Allier	19.200
Tarn and Garonne	20.800
Loiret	17.700
Vienne	20.200
Indre and Loire	19.700
Dordogne	20.300
Indre	18.000
Tarn	23.700
Moselle	18.900
Haut Garonne	22.000
Lot	20.800
Isère	17.100
Maine and Loire	18.900
Corse	24.900
Puy de Dôme	22.700
Charente Inférieure	19.600
Vaucluse	26.400
Ardèche	18.900
Drôme	21.600
Herault	23.600
Beaujolais	21.000

Cher	19.300
Loire and Cher	17.600
Corrèze	17.700
Gironde	19.500
Saône and Loire	20.700
Yonne	18.700
	624.300
At British proof, general average of French red wines	20.810
Absolute alcohol	11.874

Wines of the sherry districts of Spain.

Samples.	Highest strength.	Lowest strength.	Above average.	Below average.	General average over all.
Cadiz, thirty samples (white)	44.200	13.100	13	17	27.060
Seville, thirty samples	40.300	27.500	14	16	33.970

General average of the strength of natural red wines of various countries.

Countries.	Strength.	Averages.	Absolute alcohol.
Italy:			
Piedmont	20.900		
Lombardy	19.900		
Naples	23.700	General average for Italy, computed at British proof, by J. B. Keene: 6÷130.200=21.700.	12.382
Roman States	16.800		
Tuscany	20.400		
Sicily	28.500		
Zollverein:			
Baden	19.900		
Würtemberg	17.600	The Zollverein: 3÷58.300=19.433	11.088
Rhenish Prussia	20.800		
Austrian Empire:			
Austria (proper)	21.800	Austrian Empire: 2÷42.300=21.150.	14.037
Hungary	20.500		
Australia:			
New South Wales	25.900	Australia: 2÷49.200=24.600	14.037
Victoria	33.300		
All France, thirty departments	624.300	30÷624.300=20.810	11.874

Five samples of the red wines of Spain, from Tarragona.

Highest strength	34.100
Lowest strength	20.400
Above average	5
Below average	1
General average over all	30.25

JOHN I. BLEASDALE, D. D.,
Analyst.

California wines.—During the last three years I have availed myself of many opportunities to study and analyze California wines; and considering that a statement of the more interesting of the results arrived at would have value as serving for comparison with the French clarets, I have submitted 48 samples from the principal vineyard districts of the State. The greater part, however, were produced in the cooler and medium climates, where the conditions are not very dissimilar to those of the most fruitful and extensive wine-yielding departments of France. The tables of French strengths, as found by Mr. J. B. Keene, forming Appendix 2, it will be seen, extend over 30 different departments of France; the wines produced in each of which are shown in their general averages.

The following list shows the average strengths of the natural wines distilled by Mr. Keene in 1874-'75 (1,265 samples in all), and may be of some value:

	Average percentage proof spirit.
Australia	26.39
California	24.83
Servia	24.27
Spain	24.18
Portugal	24.07
Russia	23.43
Greece	22.31
France	20.47
Italy	19.69
Germany	19.41

APPENDIX 3.—*California wines.*

District.	Growers.	Names of wines or of grapes.	Age.	Specific gravity by balance.	British proof.	Alcohol.	Remarks.
			Years				
Sonoma Valley..	George Hooper....	Miss. White....	4	.98246	23.600	13.466	The first thirty samples are natural, and the following nine are fortified more or less: Sonoma County, thirty samples: General average, 22.534; above average, 11; below average, 19; highest strength, 28.610; lowest strength, 14.600; alcohol, per cent., 13.8586.
	Do.....	Tokay	4	.98102	25.800	14.726	
	Do.....	Table claret....	5	.98421	20.000	11.412	
	Do.....	....do	4	.98842	14.600	7.318	
	Do.....	....do	4	.98810	15.300	8.730	
	Do.....	Miss. White....	5	.98143	25.100	14.328	
	Do.....	Tokay	5	.98189	24.500	13.980	
	Do.....	Chablis	5	.98429	20.800	11.868	
Sonoma	J. Gundlach	Gutedel.....	6	.98169	25.200	14.400	
	Do.....	. do	7	.98242	23.500	13.428	
	Do.....	Zinfandel.....	4	.98384	21.800	12.459	
	Do.....	. do	4	.98391	21.400	12.228	
	Do.....	Riesling	6	.98082	26.100	14.875	
	Do.....	Cabinet Gutidel.	6	.97937	28.610	16.316	
	Do.....	Zinfandel	2	.98483	19.900	11.355	
	Do.....	....do	5	.98319	22.350	12.758	
Sonoma County.	Kohler & Frohling.	White wine	3	.98530	19.200	10.971	
	Do.....	Tokay	3	.98257	23.600	13.423	
	Do.....	Zinfandel.....	3	.98478	20.100	11.485	
	Unknown.....	Riesling	5	.98221	24.220	13.820	
Santa Rosa, Sonoma County.	J. De Turk.....	Miss. White....	2	.98560	18.600	10.613	
	Do.....	Zinfandel	2	.98520	19.250	10.985	
	Do.....	do. & black grape	3	.98576	18.600	10.613	
	A. Haranzthy.....	White Zinfandel	3	.98552	18.920	10.796	
	Do.....	Miss. White....	3	.98593	18.350	10.470	
	Do.....	do	2	.98452	20.500	11.697	
	Do	Dry Muscat of Alexandria.	3	.98276	23.200	13.238	
	Do.....	Zinfandel.....	4	.98386	21.700	12.382	
	Do	Riesling	3 & 4	.98376	21.800	12.439	
	Do.....	Riesling	3	.98388	21.650	12.353	
Napa County...	Unknown.....	Gutedel.....	3	.98440	20.500	11.697	Napa County, eight samples: General average, 21.803; above average, 4; below average, 4; highest strength, 25.000; lowest strength, 18.000; alcohol, per cent., 12.4281.
	Landsberger	Berger	2	.98600	18.000	10.271	
Saint Helena....	Do	Miss. White....	3	.98376	21.700	12.382	
	Do.....	Zinfandel.....	2	.98576	18.600	10.613	
	Do.....	Riesling	3	.98247	23.300	13.314	
Calistoga	Schramm	Zinfandel.....	3	.98160	25.000	14.285	
	Do.....	....do	3	.98204	24.250	13.857	
	Do.....	Riesling	2	.98280	22.950	13.114	
Yolo County....	Unknown.....	Miss. White....	3	.98396	21.400	12.211	One sample.
Alameda	Keene	Malvasia	3	.98120	30.450	17.395	Two samples fortified wines, viz: Alcohol, 17.2160.
	Do.....	....do	3	.98200	30.910	17.637	
Santa Clara County.	General Naglee...	Catawba.....	3	.98080	26.200	14.950	One sample.
Los Algeles County.	Lachman	Tokay	5	.98576	30.250	17.261	Los Angeles County, six samples: General average, 30.896; above average, 4; below average, 2; highest strength, 31.400; lowest strength, 28.100; alcohol, per cent., 14.0233.
	Kohler & Frohling.	Angelica	5	.97918	28.900	16.514	
	Do.....	... do	5	.97798	31.400	17.917	
	Do.....	Port	5	.97977	28.100	17.460	
	Do.....	Sherry.....	5	.97856	30.300	17.289	
	Do.....	....do	5	.97918	29.100	16.604	

NATURAL WINES.—Average of fifteen samples red: British proof, 20.0098 per cent.; alcohol, 11.4209 per cent. Average of fifteen samples white: British proof, 23.4853; alcohol, 13.4012.

General average of the fortified wines: Alcohol, 15.6196; general average of the natural wines: Alcohol, 12.4110.

JOHN I. BLEASDALE, D. D.,
Organic Chemist.

The chairman announced the paper open for discussion.

Professor RILEY wished to make a statement in connection with the facts given which he thought was rather significant. About one-third of the superficial area of land devoted to grape culture has been ruined and abandoned during the last ten years because of the ravages of the phylloxera, and the wine product of that country has been correspondingly diminished, though you study the statistics of the country you find that the sale and export of wines have not diminished in anything like the same ratio. It is a fact that large quantities of California wine have during the past two years been shipped directly from California to France and returned to this country after having been "fixed up" and relabeled with the brand of French wine.

A DELEGATE. I wish to inquire what varieties of grapes are mostly raised in California.

Mr. SARGENT. I understand that there are three hundred varieties cultivated in California, many of them of course being "fancy." A Black Hamburg, our old Mission grape, and the standard varieties of France and Italy are those used for wine-making there. I would like to remark that my knowledge of this subject comes simply from a general study of the State, and I am sorry that some of our viticulturists are not here to give the facts more in detail.

The DELEGATE. I am informed that foreign grapes are mostly raised there. Our heavy wines, such as the catawba, are much superior to those made from any foreign grapes. I would like to know why these grapes are not planted there.

Mr. SARGENT. California varieties of grapes, which would die in a French vineyard, take on a vigorous growth with us. The flow of sap is so great that it drowns out insect life. My impression is that the Catawba is not used while the Mission grape, luscious to the taste and of tender skin, is largely used.

The DELEGATE. I have seen some statement that the phylloxera is troublesome in California.

Mr. SARGENT. Very slightly, and in the instances when it has occurred it is thought to come from imported vines. All these diseases of the vine make very little progress there, and soon die out.

Dr. McMURTRIE thought that most of the vines grown in California were Hungarian. He thought that a little more than 5,000,000 gallons, as stated by Mr. Sargent, were imported from all sources. In regard to the character of wine brought from France, Mr. Sargent had called attention to the laws of that country. The statistics show that in 1878 France produced about 25,000,000 hectoliters.

The annual consumption amounts to about 40,000,000. The production of France in 1880 was about 33,000,000 and the importations from all sources about 7,000,000, so that even for that year the stocks available were barely sufficient for home consumption, and it has always been a question with me where they get pure wines to export to the United States.

Professor TAYLOR thought the question raised with regard to the character of the vines of California very important, and after referring to the eleven distinct species in this country and their adaptability to different sections, called upon Mr. Saunders for further information.

Mr. SAUNDERS said it was well known that the wines of California are produced from the same class of grapes as the wines of Europe. He could not say why they grew those grapes instead of our own native grapes. Mr. Longworth had spent $30,000 in importing foreign grapes, and at last had to resort to Catawba, which shows that an early idea prevailed that good wines could not be produced from our American species, and foreign grapes were introduced. When California first entered into the cultivation, they found that the foreign grapes did very well. They had been planted by the early missionaries, who, many years before, introduced the foreign grape. They were known as the Mission grape, and he presumed that better wines are made from them than from the fruit of American vines. He had seen a statement that American grapes would not make raisins. Raisins are not made from American grapes, but from grapes grown in America. We have not yet found any of our American varieties that will make raisins fit to compete with the raisins made from the foreign grape.

Mr. Saunders was of the opinion that wines from American grapes would increase in value as we go on improving our American varieties. We should bear in mind when we talk about California wines and raisins that we are then talking about a product produced entirely from foreign grapes.

Mr. Chamberlain, from the committee on resolutions relative to the exclusion of American products from France, submitted the following report:

To the Chairman of the National Agricultural Convention:

Your committee, to whom were referred the resolutions relative to the exclusion of American products from the markets of France, and recommending retaliatory legislation by Congress, beg leave to report:

That, in our opinion, the said resolutions involve grave and delicate questions of international policy, which this convention has not the time fully to discuss, nor the ability to pronounce upon without the most careful deliberation; and further, that these questions do not fall within the proper scope of our deliberations.

We therefore recommend that the entire subject be left to the wisdom of the proper departments of our government, without any special action or recommendation from this body.

Respectfully submitted.

W. I. CHAMBERLAIN,
ALEX. HERON,
G. D. FISHER,
Committee.

Mr. CHAMBERLAIN. I wish to say on behalf of the committee that there is no intention of discourtesy to the gentleman who kindly favored this convention with his views on the subject, but the report of the committee shows why, in our opinion, this convention cannot wisely handle the resolutions.

The report of the committee was adopted.

Professor RILEY wanted to add a word in reply to the question as to why the *Vitus vinefera* is grown in California in preference to our American species. The climate being more favorable, the vine flourishes better than ours. Another reason is that until within a few years our American grapes have not produced wines that would compete or compare with the better class of European wines, principally because nearly all our native varieties have a fiery flavor, which is very distasteful to the wine drinker, especially if he has formed the taste in Europe; this is the reason why those that are native east of the Rocky Mountains have not made their way into California. They are being sent there at the present day in larger and larger quantities,

because we have already shown that some of our varieties do make an excellent wine. The professor believed that eventually some of our species would be found growing side by side with the European vines.

Mr. SARGENT believed that one reason why the European grape does so well in California is because the climate is so favorable to its development and there being no danger of mildew. There is no reason why a delicate grape should not grow there in luxuriance. He suggested that while they might be called "foreign" grapes, they were in reality American. The Mission grape had been planted there a hundred and twenty years ago, and are certainly native to the soil.

Mr. SAUNDERS said that the foreign grape was sometimes talked of as being "weak," and our native grape as being "strong." The foreign grape is quite as strong as the latter, and makes as much wood. He had known them to make a growth of 30 feet in length in one season. There is no trouble about the vitality, provided it has the proper climatic conditions. The European grape suffers sooner from dry weather than our American grapes do, although both of them will sometimes show the same appearance of mildew on the upper surface of the leaf; and it is generally supposed to be caused by want of moisture. He had noticed years ago that sometimes one grape was attacked, sometimes another, and sometimes both, under certain conditions. If you can prevent the foreign grape from mildewing, you can grow it here as well as in California. He had grown the Black Hamburg in Baltimore thirty years ago. It is a matter of climate simply, and this is the reason why we cannot grow the best foreign varieties. In growing these finer varieties we must select climates exempt from mildew. What is known as the chicken grape has many of the characteristics of the best wine grapes of Europe—very little pulp and plenty of rich juice.

Mr. Saunders thought the time would come when our best grapes would be produced in the highlands of Virginia. The time will come when the land will be sought to suit the grape, and not until then will Americans be able to produce the best wines from their native grapes.

The PRESIDENT. Inasmuch as this subject comes up under another head, the Chair will call for a paper on the "Horticultural interests of Wisconsin," by Mr. Peffer.

The following paper was then presented and read by Mr. Smith, of he Wisconsin delegation:

HORTICULTURE IN WISCONSIN.

BY MR. PEFFER.

Mr. PRESIDENT AND GENTLEMEN OF THE CONVENTION: Horticulture in our State may properly be divided into three divisions, viz: First, apple and pear growing; second, the smaller fruits and flowers, and third, market gardening. We will consider the subject very briefly under the three heads.

The history of the apple and pear growing interest in the State has not, upon the whole, been as great a source of profit to those engaged in it as either of the others. When the wide-awake eastern men first began to settle in the Territory, they, very naturally, brought many of their eastern tastes with them, and among them was the desire for fruit. It was very natural and reasonable that they should think that the varieties of apples and pears that did well and were almost universal favorites in their native States, in about the same latitude as they were occupying here, should likewise do well here. They planted and grafted and set with their pet varieties, and after years of toil and care they found to their sorrow, as well as their great pecuniary loss, that their trees were nearly all dead or dying. What should be done? The idea of giving up in despair after one disappointment, however severe it might be, is not a common trait of either our eastern men or of their descendants in the West. They had not the experience of others about them for their guide; hence, there seemed to be but one of two courses left—either to abandon apple and pear growing, or else to

commence anew with other varieties, and almost blindly guess as to such ones as might prove to be a success. They chose the latter course and commenced a long series of experiments which is yet far from an end. To say that they made no progress would be as unjust as to say that they had been completely successful. As regards the measure of success, perhaps, I can do no better than to give a few statistics from our secretary of state of the crop reported for the year 1880. This volume reports 67,466 acres of land in orchard. The crop given was 3,743,374 bushels of apples. It is said that one-fifth of the crop was neither gathered nor reported. It should be said in this connection that the apple crop of 1880 was undoubtedly the largest one ever grown in the State. In 1881 it is estimated at only 587,649 bushels. This short crop is doubtless the result of overbearing the previous year, followed by a winter of almost unprecedented severity, combined with other causes, which also rendered the fruit itself much more imperfect than usual, but present indications are that we shall have a very large crop next season.

The varieties that are thought the best, all things considered, and are recommended by the Wisconsin State Horticultural Society, are the Duchess of Oldenburg, Wealthy, Pewaukee, Haas, Famense, and Plumb's Cider. An additional list, recommended for favorable locations, is as follows: Tetofsky, Red Astrachan, Saint Lawrence, Fall Orange, Price's Sweet, Alexander, Utter, Westfield, Seek-no-farther, Willow Twig, Golden Russet, and Walbridge. The lists have been changed as the fruit growers have perceived that their recommendations might be improved by dropping one or more from the list, and adding some variety that promised better than the one left off. They will doubtless be changed in the future, for our fruit growers are enterprising and energetic men, and will not rest until we have a list of trees that are as reliable and give as good quality as the standard orchards in the fruit growing districts of the East, and this is not claimed for the present one.

Of pear trees it is estimated that there are over five thousand in the State, of bearing age. These are mostly within from two to twenty miles of the lake. The Flemish Beauty is considered the most reliable variety grown. As a whole, pear growing has been much less successful than that of apples.

Of cherries there are 867,000 trees reported, mostly Morello, Kentish, and Early Richmond. The sweet varieties have not thus far been successfully grown. Of plums there is no report. Our soil and climate is not unfavorable to their perfect development; but the curculio is the great destroyer of the crop. Some varieties of the wild plum are at least partially proof against their ravages, and in such cases good crops may be expected. This is true of the Miner, De Soto, Winnebago, and some others, their quality also being good.

Regarding this branch of our subject, it may be said that our fruit trees grow much more rapidly than upon the Atlantic coast. They come into bearing much earlier and are not as long-lived as eastern trees of the same species and varieties.

We will now turn our attention to the smaller fruits for a short time. While not commercially as important as the apple crop of 1880, it is certain that they are our most valuable fruit interest. This may be regarded as an exaggeration, but in proof we suggest the many and varied locations where they are perfectly at home, but where the larger fruits can never be successfully grown; the short time required for their production, thus bringing them to the new home years before the larger fruits are available, and also bringing them to very many who, for business or pecuniary reasons, may not be freeholders or long residents in one place. A plantation of strawberries may be made in September, which will yield paying returns the following June.

In regard to this fruit, Wisconsin seems to be highly favored. With good cultivation, the Wilson is almost a certain crop. One of the growers of the State who has had them under cultivation since 1860, has since that time failed but once to have at least a paying crop; and usually they have been very large, over 200 bushels per acre being a not uncommon yield. One of the largest, if not the largest, crop ever reported upon one-fourth of an acre in the United States was from Wisconsin. It was 3,571 boxes of merchantable berries, or at the rate of 446¼ bushels per acre. Probably the Wilson constitutes more than three fourths, if not seven-eighths, of the entire amount grown in the State. Many other varieties are being experimented upon, but thus far nothing seems to be able to supersede the Wilson. It is to be hoped that we shall soon have two or more varieties that will at least equal this one in quality, productiveness, &c, and one of them be at least one week earlier, and another from one to two weeks later, and thus lengthen our strawberry season. Our varied soil, altitude, climate, &c., make the culture of all the small fruits suited to our latitude not only possible, but usually very successful.

Not content with smiling on and blessing all the efforts of the cultivator, Dame Nature promptly takes up the work where he lays it down, and goes steadily and bountifully on to produce annually thousands of bushels each of raspberries, blackberries, whortleberries, and cranberries.

Of the first two, from their native wilds, comparatively little use is made, except in a few counties in the northeastern portion of the State, where they are the source of

quite a large revenue; but of whortleberries our annual harvest brings into our treasury $50,000 to $80,000; and the value of our cranberry crop, produced by simple and very cheap modes of culture, reaches nearly or quite half a million dollars annually. What this interest may become when carefully developed is a question requiring as much thought and study as do the possible developments of our grain or live stock interests.

In the improvement of cranberry marshes, thus far little has been done beyond making ditches and throwing up dams of the material from the ditches, so as to control more or less perfectly the water falling upon and flowing over their surface. The marshes are composed of peat from 1 to 4 feet in depth, resting upon white sand, the sand gradually hardening into a soft sandstone at a depth of 10 to 15 feet. The surface is heavily coated with moss 8 to 12 inches deep, and is very fresh and luxuriant where water is plenty. The surrounding lands are all sand, with 1 to 3 inches of poor vegetable mold on the surface, and have an average elevation above the marshes of only 2 to 4 feet.

In improving, the first effort is to kill the moss, then to get a full stock of vines rooted in and through the dead moss, well down into the solid peat, then to get a flow of water to fully cover and protect the vines from about November 15 to May 1. With these points accomplished, the production of a crop each year is comparatively sure, and further danger of failure will arise only from insects and untimely frosts. In many cases moss killing and stocking with vines is slowly and imperfectly done, and in no case, to our knowledge, has the eastern method of coating heavily with sand and planting vines thereon, been thoroughly tried. Experiments in this direction would be full of interest and might lead to better and more successful methods of increasing the area of productive vines. To eastern cultivators, a method of improvement and culture involving an expense of only $5 to $10 per acre, must seem very slipshod and inefficient, and so it doubtless is. Western cultivators are anxious to learn of better methods, and any details of the management of eastern marshes will be interesting to us.

The production and consumption of strawberries and raspberries is rapidly increasing. The markets of all our towns and villages are well supplied and at moderate prices, which, while they afford the producer a living profit, are still within the reach of all the people, and all are fast learning that these delicious fruits are more healthful than pork, and cheaper than medicine. This knowledge and practice reaches far beyond the town and village, so that plantations of strawberries, especially, are becoming an important item in the general farm garden.

Grapes are little grown for wine, but very generally grown for home use and the village or city market. On our southern slopes and table-lands, Concords and other leading sorts are a paying crop at 3 to 5 cents per pound. The Delaware and Rogers numbers 3, 4, 9, 10, 15, 19, and many other varieties are doing well in many places. The Northern Wisconsin Agricultural and Mechanical Association, whose fairs are held at Oshkosh, and which is supported by the northeastern portion of the State, has long been noted for its splendid exhibitions of grapes. In Delawares it may well be doubted whether its exhibitions are surpassed by any in the United States. These are almost exclusively grown in what is called the Lower Fox River valley, viz., the counties about Lake Winnebago, and thence down the Fox River to Green Bay. One grower near the shores of Lake Winnebago has seventy varieties now under cultivation.

Currants are readily grown, and, with reasonable care, are an almost certain crop. One of the growers who has had a small plantation of them in bearing since 1860, has never failed to have a large crop every summer since that time. He manures his ground well every spring, keeps it free from grass and weeds. The varieties mostly grown are the Red and White Dutch. In all the small fruits we are "well up" in the new and choice varieties. Novelties, even at novelty prices, find an early place in many amateur collections, and are very soon supplied from all our leading nurseries. True, we often gather disappointment instead of fruit therefrom, but our courage and faith never flag.

Floriculture in our State, if regarded only in a commercial point of view, would not figure very largely in the account of either farm or garden products. There are but comparatively few persons who make it an exclusive business; still there are many green-houses that are doing reasonably well, and the number is annually increasing. There are some private ones of which Wisconsin may well be proud; that of Mr. Alexander Mitchell, of Milwaukee, being considered one of the finest and best in the western country. The number of amateur flower-growers in the State is large, indicating refined and educated taste among our citizens, and we believe that no State of our age can make a better showing here than ours.

We will now briefly consider market gardening. Except for the home trade, it is confined mostly to the eastern part of the State, and is carried on most largely for outside markets at two points, Milwaukee and Green Bay.

The home markets are and have for years been well supplied with all the fruits and

vegetables of our soil and climate by the small growers in and about our towns and cities.

A few words upon gardening are all that need be said at this time. Our system is much like that of and about New York—heavy manuring and thorough cultivation being with us, as with others, the two things absolutely essential to a successful result.

Perhaps I may, in this connection, be allowed a few remarks on the system as conducted about Green Bay, being better acquainted with it there, as being my place of residence, than elsewhere, and also serving to illustrate other portions of the State. There are good water communications both to north and south; and also railroads reaching in all directions. These, in competition with the water routes, usually give us reasonable and sometimes low rates of freight. In the great lumber and mining districts farther north but little attention is paid to agriculture in any of its branches; consequently, there is a large market there for all kinds of farm and garden produce, and ours is the nearest point from which the want can be supplied. The business of furnishing outside markets commenced about fifteen years ago, and has since grown to quite large proportions, as within the past few years shipments have also been made to New York, Philadelphia, Ohio, Indiana, Illinois, Missouri, Minnesota, Colorado, Texas, and possibly to other portions of our country. Perhaps the best evidence that the business is successful is the fact that none of the gardeners are willing to sell out, except at very high prices.

The question is often asked, "Is not Green Bay too far north for such a business to be successful?" Its latitude is 44½°. Here are a few dates giving the time of the first appearance of some of our crops of entirely out-door culture. The earliest date for commencing plowing, land being in good order, was March 12. The latest was last spring, April 17. The earliest cuttings of asparagus were April 13. Pease have twice been ready for picking June 5, and strawberries June 6. Sweet corn has been in the market July 21. These dates extend back for a series of twelve to fifteen years. They are given as the earliest for such crops within that time, and are of course a few days earlier than the average season with us. Twice within twenty years crops have been killed by frosts in September. Last fall frost was not sufficient to kill Lima beans, except the outside leaves, until October 20.

It should be borne in mind that all the remarks of this paper in regard to either fruit, floriculture, or market gardening are applicable more particularly to that portion of the State south of 45 degrees of latitude. One-half of the State, lying north of this range, is comparatively undeveloped as regards its agricultural capacity. It is now being closely intersected with railroads, and in the near future is doubtless to become the home of a large and thriving agricultural population.

Our State Horticultural Society is not a large one in numbers. I think this is at least partially compensated for by the fact that a large proportion of its members are well-educated, energetic, persevering men whom no discouragements thus far have been able to keep from pursuing a course which we all believe must eventually prove a thorough success, although to many it has seemed to be long in its coming.

The society is about twenty years old, and issues a yearly volume of transactions, which is published by the State, and which, we think, will compare favorably with that of any of our sister States in the Northwest. In one respect we believe that we may justly feel proud of our society. We have a corps of lady writers who annually come forward with their well-prepared papers, and read them at our conventions. They are the wives of our lawyers, teachers, editors, and last, but by no means least, the wives of our farmers. In this we feel that our volume cannot be exceeded if, indeed, it is equaled by any one of its kind in the United States.

This, Mr. President and gentlemen of the convention, is a brief synopsis of the condition of horticulture as it at present exists in the State of Wisconsin. It is imperfect, but your time here is valuable, and other States have claims that may not justly be disregarded. As has been stated, those who have been engaged in some branches of fruit-growing have met with many discouragements, but their courage does not fail. They believe they are working for and toward a great and grand result. They believe that they will accomplish it. Those who are engaged in different branches of business hope and trust that they will succeed.

We have a noble State. We feel that we may justly be proud of being one of the galaxy of States of the grand Northwest, as well as one of the sister States of our Union. In the different branches of horticulture we will not claim any leadership; still, my friends, you may rest assured that we shall not consent to lag behind in the race of progress and improvement. And as you of our older and more thoroughly developed States go forward step by step from one high position to others still higher in your career of progress, as you look about to see those who are keeping pace with you, among the numbers, I feel sure, will be found our own beautiful Wisconsin.

Mr. THOMAS TAYLOR, referring to cranberry culture in New Jersey and the New England States, said that several years ago he had visited a great many of the cranberry plantations of these States for the purpose of discovering the cause or causes of cranberry rot, so prevalent at that time. As a result of his investigations he found that as a rule the rot of the cranberry prevailed principally on plantations where the peaty soil was in a state of fermentation. He recommended to the growers, as a remedy for this condition of soil, liming and thorough irrigation. He found, on making inquiries three years afterward, that several of the large plantations which were treated in this way ultimately produced improved berries, free from rot.

In preparing new soil for planting, the methods vary with the conditions presented in each case.

The most successful are those cultivated on old mill-ponds. Many of these ponds have been out of use for a period of from 30 to 60 years. In this case there is a great accumulation of vegetable, muddy *débris*, averaging from four to five feet in depth. In order to utilize this vegetable matter, the water is drawn off slowly, allowing the sediment to be precipitated to the bottom, forming a loose, peaty loam, well decomposed, varying, when consolidated, from 6 to 15 inches in thickness, resting generally on a porous foundation of sand or gravel. It is found as a general rule where water is plentiful that an absorbing foundation has great value, because the soluble matter of fermentation, such as organic-acids, &c., are quickly removed from the cranberry vines which may be growing under such conditions.

When the soil is ready for planting, from four to six cuttings of the vine are planted about 12 inches apart over the entire surface thus prepared. The cuttings take root quickly under favorable conditions. On the second year they bear a small amount of fruit. On the third year the crop may average from one to two hundred bushels of berries per acre.

When cranberries are cultivated on black sand, which is a mixture of peaty matter and sand, the vine roots sometimes suffer severely from lack of water, especially when they depend more on direct rainfalls than on running water. In this case a clay substratum has a great advantage when situated at a depth of about 18 inches from the surface. The clay retains the moisture for a long period, supplying the roots with the needful element until further rains supply the upper stratum of sand in which the plants are growing.

Common bog-land is generally covered with moss and many varieties of weeds.

The surface or sod is sometimes removed and burned and the ashes returned and spread over the surface. It is valuable in imparting a loose mechanical texture to the soil. The vines are planted on bog-land in the manner already described. It is found that vines planted closely cover the entire surface very quickly, and in a great measure prevent the growth of weeds. When lime was first applied to the cranberry vine in the State of New Jersey it was spread over the whole surface of the bog at the rate of 40 bushels to the acre; considering that the lime was freshly slacked and applied in the dust form and quite caustic it was feared that the foliage would be burned up, but not a leaf wilted, although in some instances the foliage was covered as much as an inch in thickness with lime dust.

When cranberry vines are planted on bog-land which is in a compacted fermenting condition and several feet in thickness, the land should be first drained, then plowed as deeply as possible, and heavily

limed and exposed during the winter, thus allowing the surface soil to pass through the stages of fermentation. The land should also be well trenched and subjected to thorough irrigation to free it from organic acids, sulphureted hydrogen, and sulphate of iron, products which frequently abound in bog-land, and which may come to the surface in time if not removed by drainage. The sprinkling of sulphate of lime over growing moss destroys it for a time, and the dead moss serves a good purpose in keeping the surface of the soil moist. Cranberry roots readily take root in moss and grow thriftily, provided the roots of the moss are kept moist with running water.

Mr. PEFFER said: They have used lime in Wisconsin at the rate of about 20 bushels to the acre, and it was a question whether that might not be safely used on the green vine. But he found that after two weeks of the application of the lime, where the new plants were, that when he removed it there was a certain appearance of scorching, and it may be believed that when scorched at all the vines will be destroyed and die right down. One gentleman had limestone formation, and low-lands, sloughs, or marshes, and they were about 4 or 5 feet deep. He removed the surface about 4 or 5 inches, set the plants in the summer, and tore away or burned up the moss, and then planted the cuttings 2 feet apart. For two years no weeds had appeared. This makes our bed, and in two or three years the vines will cover the ground, and commence bearing the second year, and the third year will produce well. Several plantations in his country have been very successful.

One who has never seen our fields can form much of an opinion of their capabilities. From all he had heard and read, and the little he had seen of Western cranberry growing, he thought a hundred acres such as they make would make a Jerseyman very happy, for the reason that they do so little and get so much. Our best fields are of sandstone, where the water is as soft as rain-water from the clouds. The gentleman last speaking with reference to this paper said we tore up our moss and threw it away. The moss is destroyed only by salting the ground thoroughly, and draining the water off entirely on a warm, sunny day when the sunshine strikes it, and then the hot sun destroys it; then it will come down to one-third of its original size and becomes a nice bed.

Mr. TAYLOR. Then you do not plant any to fill out those that are lost in different places?

Mr. PEFFER. Oh, yes; about nineteen-twentieths is produced on vines that nature has planted. We have got the water to them where it was lacking. Our planting has been too far apart and took too long a time. The impression was that about two or three years would give a good growth, but it does not. Five years will produce the finest crop. We never have used sand to any extent. He learned, from reading some interesting reports recently, that it is the custom to use sand to raise cranberries for the Eastern market; is that so?

Mr. TAYLOR. Yes, sir.

Mr. PEFFER. Our vines seem to do very well, as they grow readily into the dead or decaying moss, and that moss becomes less and less, from year to year, and almost disappears. Then the growth of the vine is built up from year to year. The yield is as high as two or three hundred bushels to the acre, where the vines have the proper age.

Mr. TAYLOR. They grow up through the moss?

Mr. PEFFER. No, sir, after the moss is killed; one year's growth after another, there will be a depth of cranberries from five to seven inches through the whole crop.

The hour for adjournment, having arrived the president declared the convention adjourned until 2 o'clock.

The convention reconvened at 2.50 p. m.:

The PRESIDENT. The chair understands that the report of the committee on signal service is ready, and he calls upon the chairman to present it.

Mr. BUCHANAN. The chairman of the committee is absent and requests me to act in his place. I offer the following report:

The committee appointed to consider the relations of the United States Signal Service to the agricultural interests of the country, and to present such statements and suggestions, as might, in the judgment of this convention, be deemed proper to be commended to the attention of the Chief Signal Officer, General W. B. Hazen, beg leave to submit the following report:

1. The Chief Signal Officer has already instituted special services for the benefit of agriculture by way of forecasting, and, as far as practicable, giving timely notice of the approach of northers, frosts, rain-storms, &c. The cotton, sugar, and orange producers are understood to be the special beneficiaries of this service. Within the cotton belt there are now one hundred and fifty stations from which daily reports of temperature and rainfall are received. A special service is also under consideration for the benefit of the grain-growing interests. The feasibility of extending similar services to other agricultural interests and notably those of hay and tobacco is suggested.

2. The Chief Signal Officer has already suggested to the governors of the several States the expediency of instituting a system of weather service to be conducted by the State authorities upon a plan furnished by the United States Signal Service. Meteorological data could thus be gathered through the agency of the State central officers from every county in each State, and thus the climatic conditions of every locality be made known. The data thus collected and published by the United States Signal Service would be available for every purpose for which such data are needed, and could be especially utilized by the Department of Agriculture in determining important questions relating to agricultural production. For instance, if studied in connection with the thorough and comprehensive crop reports so earnestly and justly insisted on by this convention, they would furnish means of ascertaining to what belts or sections of country certain crops are, or are not, appropriate. Some of the States have already adopted the suggestion of the Chief Signal Officer respecting the institution of weather services, and in other States the matter is awaiting legislative action.

3. The United States Signal Service is conducting observations with a view to suggest, if possible, some means of preventing the devastations of grasshoppers in the West. It is suggested by the Chief Signal Officer that it may be practicable to search them out in their fastnesses and destroy them before they begin to migrate from their hatching grounds.

4. These measures adopted by the Chief Signal Officer in the interests of agriculture are duly recognized and appreciated by this convention; and they cordially indorse any efforts he may make to secure on the part of Congress such legislative action as may enable him to carry out these and any other measures which tend to advance the manifold agricultural interests of our entire country.

JOS. A. HOLMES,
S. H. PEABODY,
JNO. L. BUCHANAN,
A. E. BLOUNT,
Lieutenant BIRKHEIMER,
Committee.

The report as read was adopted.

The president stated that the first paper in order was that by Dr. McMurtrie on the mineral nutrition of the vine.

Dr. McMurtrie then read the following paper:

ON THE MINERAL NUTRITION OF THE VINE FOR THE PRODUCTION OF WINE.

BY WM. MCMURTRIE, PH. D.

GENTLEMEN: It is not without a feeling of considerable diffidence that I appear before you to present my views on the subject of this paper, both because of the vastness and importance of the subject and the industry it represents, and because I see before me

many gentlemen of a wide experience in practical and successful vineyard management, of which it is certainly not my privilege and right to boast. What I have to say is based upon rather careful observation among some of the more celebrated vineyard districts of the old world, and study of the results obtained in Europe in practical and scientific experimental research. And if the standing this great industry has acquired there, and the great wealth it has added to many of the leading nations of Europe may be taken as evidence of the value of these results, then the principles to be deduced from them may undoubtedly be applied with confidence to the treatment of our vineyards, and the improvement of their comparatively undeveloped productions. For I firmly believe that whatever may be done to increase the quantity and improve the quality of our wines will tend to the material and permanent advancement of the industry here, and if anything I may present will to the smallest degree tend to that end and contribute anything to the knowledge and the improvement of grape culture in the United States, the object of this paper will have been fully attained. I firmly believe that whatever may be done to enable the American vintner to produce large crops of healthy wines of medium quality that may be early sent to market and sold at low prices and thus made to yield quick and profitable returns, will do more to make the industry take a prominent rank among our agricultural productions than the production of special wines can possibly do, and will secure to the vintner his permanent prosperity against any peradventure or question.

The importance of the grape and wine industry in the various parts of the world where it has been long established, or even in our own country where it is comparatively new, is so familiar a theme that it would seem almost superfluous to speak of it here, yet it may prove of interest to recall some figures, showing its relative importance to the different nations, from which the requisite statistics have been attainable:

	Gallons.
Austria, 1876	53,835,777
Hungary, 1873	99,355,640
Roumania, 1873	27,388,310
Germany, 1879	70,815,706
Belgium, 1861–1871	28,781
Portugal, 1873	91,852,000
Switzerland, 1879	31,680,000
Italy, 1880	716,404,497
France, 1880	896,263,024
Spain, 1881	1,584,000,000
Greece	39,600,000
Turkey	158,400,000
Russia	17,160,000
Grape growing Atlantic Islands	7,920,000
Australia, 1878	2,193,048
United States	23,453,827

This shows what might to some have appeared almost incredible that our country, even in this production, does not foot the list. It is another feather in the cap of our national pride, that is now destined to increase in volume until even the most favored wine-producing countries may not be ashamed to acknowledge us a rival.

There are many ways by which the improvement of our wine production might be attained; but that with which we propose to deal at this time is involved in the operations of vineyard culture rather than the cellar management, even though it has an indirect bearing upon the latter, and though there may be applied to the treatment of the must and wine in American cellars many standard principles of European practice not familiar there, and which could not fail to make an impress upon the products that would be strongly felt in the favor with which they would be received. I do not mean to intimate that the average American wine-maker is deficient in the knowledge necessary to the production of good wine, for that would justly be set down as rank treason, and it certainly would be unfair, for it is by no means difficult to obtain in almost any section of our country wines of which we have no need to be ashamed, but it can scarcely be denied that a wider knowledge of the principles and practices to which we have referred, and their wider application in the ordinary work, would do much to reduce the not unfrequent complaint of bad products coming from the consumer, and of unprofitable results coming from the producer.

The principle that continued cropping will eventually result in disastrous exhaustion, if no means be taken to supply the waste, is quite as applicable to the grape as to any other crop, and deficient nutrition will deplete the vine, decrease its products, and place it in condition to succumb to the attacks of disease just as surely as poor food and bad treatment will break down the constitution and ruin the character of the

best breed of cattle or the thoroughbred horse, while injudicious nourishment will, on the other hand, just as surely tend to the development of those qualities of increased size, extensive leaf and wood production, to the exclusion of fruit production, and to the production of thin watery and acid juices rather than the more desirable sweet ones. We shall therefore endeavor to show what shall be the character of the nutrition for the attainment of the end we have have in view and the quantity in which it should be applied to the vine.

The question of nutrition in vineyard culture, as, indeed, in most other cultures, in this country, has received less careful consideration and study and has been less a subject of practical experiment in this country than in Europe. Here the stronger and more prolific varieties grown and the greater naturally fertile character of our comparatively virgin soils have never made it a matter of such pressing necessity and question of rigid economy as it has become to the vintners of the old world, and this, together with the natural indifference of our people to the importance of such relations as must arise in this connection, may be accepted as causes of the general negligence of this part of agricultural economy. But the necessity that aroused the European agriculturists is now being felt in many parts of our country, especially in the Eastern States, and we are therefore constrained to believe that the facts we are able to present will receive at the hands of our vintners the consideration that their importance and value deserve.

The value of chemical analyses of the soil as they are usually made may justly be doubted for application in the study of the nutrition of the vine as well as in the nutrition of other crops. The reasons for this are manifest. In chemistry it is well known that the action of solvents is more ready and more effectual when the material to be acted upon is reduced to the finest possible state of division, and what is true in the laboratory practice applies to a large extent in the operations constantly being carried on in the soil. The natural solvents of the soil are necessarily weak in their action, and they must be most efficient in those soils where the largest quantity of finer particles prevail. The coarser particles which yield to the action of the stronger acids in chemical analyses, and give up the elements of mineral nutrition, resist almost completely the action of natural solvents and so much of these elements as are held by the coarser particles that must prevail in good, open, mellow soils, must consequently be unavailable in the growth and nutrition of the plant. This holds good in all cultures, but it has been made especially evident by Dr. Blankenhorn, in his studies of the composition of good vineyard soil in Germany. Thus taking the result of his analyses and calculating the quantity that would occur in a stratum one foot deep, he obtained figures corresponding with the following, in pounds per acre, showing the most important constituents present:

Thus he found of potash 4,826 pounds per acre; of soda, 2,768 pounds per acre; of lime, 25,381 pounds per acre; phosphoric acid, 884 pounds per acre; while if the same soil were treated to separate very fine particles, a stratum one foot in depth would yield but 43,382 pounds per acre, yielding, when subjected to the action of solvents approximating in intensity those of the soil, but 22 pounds of potash and 365 pounds of phosphoric acid. The crops of the vineyard represented are said to be small, and it is scarcely a matter of surprise.

In the study of the nutrition of the vine we are, from the nature of the case, compelled to confine ourselves to a study of the constituents of the plant and its parts, produced under the varying conditions and its behavior under the influence of nutritive compounds of known composition. Fortunately these relations have, during the past few years, been the subject of careful study and of patient and laborious experiment in various parts of Europe, and their results may be accepted without reserve as a guide to practical work in any part of the world.

I shall begin with an examination of the quantities of the elements of mineral nutrition annually removed from the soil of the vineyard in the ordinary operations involved in the culture of the vine. This has been estimated by many investigators, and from their results it appears that a fixed rule with regard to it can scarcely be set down because of the wide differences that occur, dependent, doubtless, upon the widely differing conditions to which the vines employed in the investigation had been subject. I shall select as an example the results obtained by Professor Neubauer, both because he stands so high as an authority on grape culture and because of the thoroughness of his work. His investigations were made with vines of the Riesling grape, growing at the Oeno chemical experiment station at Weisbaden, in Germany, where the vines were planted at the rate of about five thousand per acre. He carefully collected all the materials removed in the annual operations of the culture and vintage, and made careful and detailed analyses of the mineral matters to determine the quantities of each constituent annually consumed; and while it would be impracticable to present here the details of the results of his analyses, it will be quite sufficient and more to the point to give the figures for the total quantities of the nutritive mineral principles removed. All the figures given refer to quantities or pounds per acre. While in American vineyards the number of vines per acre never reach the high rate found in Neu-

bauer's vineyard, this will be compensated for in the more vigorous growth of our varieties, and the consequently larger product of wood. The figures referred to are as follows:

Products.	Mineral matters.	Potash.	Lime.	Magnesia.	Phosphoric acid.
4,656 pounds wood	59	.20	18.00	4.26	.780
4,369 pounds shoots	111	40.17	27.82	10.269	10.168
2,649 pounds marc	66	29.33	4.77	.360	7.048
56 pounds lees	5	3.75	4.53	.044	.409
627 gallons wine	15	9.63	1.188	.044	2.904
	256	21.88	52.231	18.613	28.349

In these figures, as in the results of analyses of the mineral matters of the vine, the potash content stands higher than any other, and thus led Ville to especially class the vine as a potash plant; but Joulie has shown that it is no more so than any other crop. Thus he calculated the relation existing between the phosphoric acid and the other constituents in the vine and other crops, and obtained the following figures:

	Phosphoric acid.	Potash.	Soda.	Lime.	Magnesia.
Vine	1	2.28	0.021	1.79	.46
Ripe wheat	1	1.28	.....	.52	.36
Wheat in bloom	1	2.25	.305	1.18	.52
Potatoes (tubers)	1	3.30	.048	.12	.24
Beet roots	1	3.65	.725	.45	.63
Meadow hay	1	4.18	1.145	1.83	.80

This shows, however, that potash stands high in all crops, and why its application in most cases to the soil is attended with such beneficial results. In the majority of soils we find the phosphoric acid present in much larger quantity than the potash, while in the plant the relation is exactly reversed. It is therefore plain that phosphoric acid may be even in excess when the potash may be wanting. This is a point worth jotting down in our memories.

Nor is the vine by any means as exhausting to the soil as many other crops. Again quoting Joulie's figures, and confining ourselves to the potash and phosphoric acid, which are really the more important constituents in all cases, we find the following relation for the several crops named in whole numbers of pounds per acre:

Thus of phosphoric acid there is consumed in pounds per acre by the vine 9.74; by wheat, 28.8; by potatoes, 37.8; by beets, 48.9; by hay, 14.5; and of potash by the vine 21.1; by wheat, 35.77; by potatoes, 124.6; by beets, 178; by hay, 60.87.

A somewhat similar relation was worked out with sugar beets, wheat, potatoes, &c., though their observations were mainly confined to the relations between the more important constituents of the product—sugar and starch—and the more important constituents of the mineral compounds present; and the same or similar relations may prove of value in vineyard culture. They found that for a given quantity of starch in wheat and potatoes a given quantity of phosphoric acid, potash, &c., is taken up by the plant. They found that for the production of 100 pounds of sugar in the beet there were consumed in the development of the plant 1 to 1.20 pounds of phosphoric acid, 5 to 6 pounds of potash, 1.5 to 2 pounds of soda, 1.5 to 7 6 pounds of lime, 1.2 to 1.4 pounds of magnesia, 2.7 to 3.5 pounds of nitrogen.

They therefore concluded that in the formation of sugar in the beet the value of a given quantity of phosphoric acid is equivalent to six times that of the same quantity of potash. On the other hand, however, it shows the advantage to be attained in the application of potash salts in quantity to the crop.

If now we follow the method of Champion and Pellet and make calculation for the quantities of these several elements of mineral nutrition consumed by the vine in development as compared with the quantity of sugar produced in its fruit, we obtain figures which differ to a considerable extent from those obtained for the sugar beet

Thus, taking for data the results of the analyses of Peneau of the different parts of the vine growing at Fenestrelay, and the figures he gives represent the yield of must; then assuming 20 per cent. to represent the average sugar content of the must, we arrive at the following figures: that is, in the production of 100 pounds of sugar in the grape there must be consumed in the development of the vine 1.7 pounds of phosphoric acid, 19.2 pounds of lime, 3.2 pounds of magnesia, and 6.5 pounds of potash.

The figures for lime here appear abnormally high as compared with the figures for potash and the other constituents, and it is difficult to account for the difference except we assume that the vine grew in a soil exceedingly rich in lime and very poor in potash, when the plant exercised its power of substitution in the absorption of nutrition that it has been shown to possess. This supposition is supported by Peneau's analysis of the soil in question. However, if we make the same calculation on the basis of Neubauer's analyses, the results of which we have already given, we find the same difference in favor of magnesia. Thus, in this case, for 100 pounds of sugar we have a consumption of 2.98 pounds of phosphoric acid, 5.0 pounds of lime, 18.6 pounds of magnesia, and 10.29 pounds of potash.

Dael von Koeth's analyses would give 2.12 pounds phosphoric acid, 4.97 lime, and 6.2 potash.

These figures tend to show that, so far as the sugar content is concerned, the total quantity of nutritive elements consumed in its production is greater than for a corresponding quantity of sugar in the sugar beet. And though the vine does actually remove less nutritive material than other crops, this shows that it would probably remove more if it had the chance.

We see, then, that a very considerable quantity of such material is annually removed in the culture, and the question next naturally arising is how to replace it. What compounds may we apply to restore this material and at the same time stimulate the production of quantity and quality in the fruit? This is an important question, and we may bring the results of European experience to our aid in formulating our reply.

We have seen that an elevation of the proportion of the leading elements of mineral nutrition of the vine corresponds with a higher proportion of sugar in the fruit. It is also true that the same condition corresponds with a healthier condition of the vine. This is evident in the results of analyses made by Professor Foëx of the mineral matter of healthy and diseased vines growing in the neighborhood of Montpellier, in France. Thus he found the following percentages in the ash of the—

Constituents.	Leaves.		Wood.	
	Healthy vine.	Unhealthy vine.	Healthy vine.	Unhealthy vine.
Potash	13.02	5.29	32.20	16.42
Soda	1.07	.41	.49	.28
Lime	55.19	60.90	41.77	52.50
Magnesia	11.33	13.18	10.88	13.43
Phosphoric acid	3.63	3.89	6.22	5.85

And Schulze found in the raw material of the vine

Constituents	Leaves.		Wood.	
	Healthy vine.	Unhealthy vine.	Healthy vine.	Unhealthy vine.
Potash	1.08	.51	1.14	.56
Soda	.09	.04	.02	.01
Lime	4.59	5.88	1.44	1.78
Magnesia	.94	1.27	.37	.46

It would appear from this that it is potash that has the most marked influence upon the health of the vine. And Bechi, in his investigations at the agricultural school at Florence, in Italy, discovered that the quantity of potash found in the vines varies with the quantity available in the soil; that when potash is present in the soil in abundance

it will be taken up in preference to other alkalies, and when this is wanting its place may to some extent be supplied by soda. Nessler's experiments also confirm it. He applied certain fertilizing compounds, and found in the vine the corresponding quantities of phosphoric acid, lime, and potash shown in the table.

Manure given each vine.

	100 parts ash contained		
	Phosphoric acid.	Lime.	Potash.
None	9.21	27.9	16.87
30 grams gypsum	8.74	22 6	18.91
15 grams potassium chloride 15 grams ammonium sulphate 15 grams calcium phosphate	12.04	30.6	23.73

Audoynaud, recognizing the influence and value of potash salts in vine culture, made a series of experiments in 1875 and 1876 to determine in what compounds it is best suited to the vine and more readily taken up by it. He applied to different plots of vines the carbonate, nitrate, sulphate, and chloride, and from the results of his experiments and the location of the potash in the different parts of the vine he was led to conclude that—

1. The sulphate and the chloride of potassium have a marked influence upon the development of the vine, but the nitrate is superior to them and the carbonate inferior.

2. Weak vines seem to consume as much potash as vigorous ones.

3. An excess of nitrogenous matters is rather injurious than useful.

4. Potash should always enter into the composition of manure for the vine, that of the soil being generally in bad condition for assimilation. Potash in some way carries with it other fertilizing principles.

6. All potash introduced by the root in the course of a season is not entirely consumed, since after fruiting a considerable reserve is found in the wood and the cane.

The experiments of the late lamented Saint Pierre, of the agricultural school of Montpellier, are of especial value in this connection. He made experiments with different kinds of fertilizing materials to determine the relation between the quantity applied, its cost, and the quantity of fruit produced. From the results obtained in 1869, he concluded (1) that chemical manures are much better for the vine than stable manures, which were almost without effect; and (2) that among chemical manures those containing at the same time potash, phosphates, and lime gave the best results. Nitrogen alone is more injurious than useful, while non-nitrogenous manures gave very good crops. Among nitrogenous manures those containing small quantities of nitrogen gave better results than those containing larger quantities. Potash alone proved excellent, and whenever it was wanting the yield was bad.

From his results of 1870 he concluded that the best fertilizing material for the vine is a mixture of salts of potash and nitrates. (2.) Neutral or acid phosphates seem to have had but little influence upon the quantity of the crop. (3.) Nitrogen in the form of nitrates gave better results than when applied in the form of ammoniacal salts. So, also, Joulie found for the sugar beet, and it is doubtless of value for application here that for the production of sugar in the beet the nitrogen of nitrates is more valuable than that of ammonia, which in its turn is more valuable than that of organic origen, and especially of animal matter.

With regard to phosphoric acid in its relation to the fruit, though it may not increase its quantity, there is reason to believe that it improves its quality. The earlier investigations of Alibert led him to conclude that wines having a strong bouquet are richer in phosphoric acid than those having weaker bouquet, and his analyses convinced him that there was a direct relation between the proportion of phosphoric acid in the wine and its quality. Thus he found one-third more phosphoric acid in Reisling wine than in other varieties. So, also, Neubauer concluded, from his examination of grapes at different stages of growth, that the phosphoric acid and potash in the fruit increased with the increase of sugar and the diminution of acid. It has also been satisfactorily proven that phosphoric acid has a tendency to hasten the ripening of the grape.

So much for the value of the several elements of mineral nutrition and the development of the vine and its fruit. Now, what shall we use to supply them? In comparing Neubauer's figures for the quantities removed annually from an acre in vine culture and deduction made from his results of analyses of cow manure, the quantities of potash found in the former will correspond nearly with that found in 4 tons stable manure.

But in this quantity we find that of the other constituents there is an excess of what is required by the average crop, while of others there is a deficiency. The rational rule of practice would, therefore, be to reduce the quantity of stable manure applied to the amount necessary to supply that constituent required in smallest quantity, in this case phosphoric acid, and add to it the other constituents obtained from artificial and commercial sources. Thus 3 tons of cow manure could supply:

	Pounds.
Phosphoric acid	15.9
Potash	39.78
Lime	45.342
Magnesia	11 61

The potash should, as we have seen in the preceding pages, be added in the form of nitrate or sulphate of potassium. And this is really the only constituent that need be added to the manure. The soil of every vineyard should contain lime in abundance, and wherever it is wanting it should be applied in considerable quantities and at regular intervals, for besides furnishing what is necessary to the nutrition of the vine, and to some extent supplying deficiencies of potash and other alkalies, it has an exceedingly favorable influence upon the soil in correcting any deleterious acidity and improving its physical condition, and exercises a disintegrating action upon organic matters holding elements of nutrition in combination. Indeed we are of the opinion that its use in vineyard culture cannot be too strongly recommended, and that the application of 50 bushels per acre every three or five years will show a marked improvement both in the health of the vines and the quantity and quality of the crop Of course this quantity should be modified according to the quality of the soil under treatment, being reduced for sandy soils and increased for clay or loam soils.

The indications afforded in the facts we have presented will doubtless be found a sufficient guide for the vine grower in the matter of manuring his vines. But a few words more in this connection may prove of value. Reference has already been made to the prejudices prevailing abroad against the use of artificial manures for application to vines, because of the danger of changing the character of the wine produced, but careful study and observation by excellent authorities on the subject in Germany have shown that this has no foundation in experience. It is easy to imagine how proprietors of the highly celebrated vineyards, and whose products have from time immemorial almost enjoyed an exceptional reputation, and have consequently brought enormously high prices, should hesitate in introducing any changes in their methods of culture or the treatment of their soils, but for the producers of wine of ordinary quality the same causes do not obtain. They want good, strong, healthy vines, yielding large quantities with the best quality compatible with that yield. M. Saint Pierre has shown how the addition of various potash salts to the soil will increase the product, and we have seen also that the relations between the sugar content and mineral constituents of the vine are nearly constant. If these constituents be wanting then sugar must also be wanting. If they be applied to soils deficient in them the vine quickly responds in the production of sugar in the fruit. We have seen that for the absorption and assimilation of 2 to 3 pounds of phosphoric acid and 6 to 10 pounds of potash by the bearing vine under such circumstances as we have just described there should be a formation of one hundred pounds of sugar. Surely this should induce some reflection on the part of the viutner. The purchase of this quantity of sugar in the market to supply a deficiency involves an expense of $8 to $10 at least, while its production by the means suggested would involve a cost of only about one-tenth that amount. And who will for an instant question that the sugar produced is in every way superior for the production of good healthy wine?

The use of commercial sugar for addition to the must is entirely too prevalent in this country, and to it may without hesitation be ascribed, to a very considerable extent, the inferior quality and unhealthy character of many of our American wines. Let this practice of sugaring the must be abandoned, and the more rational one of applying suitable fertilizers to the vineyard adopted, and we may confidently predict for the near future a sounder product, wines healthier for the stomach and pleasanter to the palate, bringing profit to the producer and good-cheer to the consumer.

That the vine responds effectually as well as promptly to the application of fertilizers, both in quality and quantity of the product, is amply illustrated in the experience of Count de Gasparin in this connection.* To determine the comparative value of manure as applied to different crops, he treated a number of crops under observation with a given quantity of stable-manure having an average value of $2.60 per ton, and noted the quantity of the product of each crop resulting. From the excess of each over the quantity yielded by the average crop he calculated the money value of the influence of the manure applied in each case. The values he thus obtained were as follows:

For wheat	$1 86
For beets	2 88
For madder	4 38
For vines	9 20
For olives	9 60

* Related by Petit Lafitte, in La Vigne dans le Bordelais, p. 375.

Showing conclusively that the vine is more sensitive to the action of fertilizers than most other crops, and yields greater profit for the same consumption of material.

In general, then, we may offer as a rule for manuring a vineyard the following: Apply stable-manure at the rate of about 2 or 3 tons per acre, and supplement it with an annual application of 200 pounds of the mixture made according to this formula:

	Pounds
Sulphate of potash*	500
Nitrate of soda	500
Superphosphate of lime	500
Sulphate of lime	500

In the relations of fertilizers to wine culture the following points are particularly to be observed:

1. In the application of fertilizers to the vineyard some preference must be accorded to those which improve the physical condition of the soil and which may increase the quantity of the product without injury to its quality. To this end stable-manure should be used in limited quantities, and lime liberally applied to those soils wanting in it, and of a compact nature.

2. To improve the chemical composition of the soil, phosphates and potash salts are principally to be depended upon. If nitrogenous compounds be used great care must be observed, and the nitrates are greatly to be preferred. Generally none are needed.

3. It is preferable to apply stable-manures or others containing nitrogen and decomposing slowly, in the fall immediately after the vintage; and all manures should be distributed as far from the base of the vine as the system of planting will permit.

4. Apply manures whenever a deficiency of crop or a weakened or diseased condition of the vines appear to make it desirable. Continued removal of nutritive principles from the soil without their restoration, will bring about these conditions, and increased vigor of growth and profitable returns in fruit will surely follow liberal supplies of these principles. *It is more rational and more economical to apply fertilizers to the soil than to add sugar to the must when the quality of the latter needs improvement.* This should always be maintained as a ruling principle in grape culture for wine making.

The CHAIRMAN. This paper is open for discussion.

Mr. TAYLOR thought that the portion of the paper referring to the amount of fruit allowed to the bearing vines was incorrect. Some vine growers consider from eighteen to twenty pounds as much as the vine would bear. Suppose they were given a certain percentage of manure to eighteen pounds, and they bore a certain relation to each other? It is very certain if they were to allow double the quantity of grapes to the amount of manure stated, that there would be a deficiency in the amount they expected from them. I would like to know whether Dr. McMurtrie ever made an estimate of the quantities to be borne by the vines as compared with the amount of nutriment supplied to the soil. How much should be allowed to each vine in proportion?

Dr. MCMURTRIE. The relations between the quantity of the product and the nutrition of the vine were set forth in my paper. Saint Pierre's investigations showed most clearly that the quantity of the product varied with the quantity and quality of the fertilizer applied to the vine. In the section in which his experiments were made in the south of France, it is common to have yields of twelve to fourteen pounds of fruit per vine. But here the vines are planted from six to eight feet apart, and if the number of vines, per acre, be increased, the yield per vine must be correspondingly decreased.

Professor TAYLOR. If you will state the number customarily planted in France I will be obliged to you.

Dr. MCMURTRIE. The figures I gave in my paper indicate a yield of 625 gallons of wine per acre in Germany. In this case they were planted at the rate of 5,000 per acre. But that is very much closer than they are planted in most of the vineyards in France, except in the more northern sections. In the middle and south the distances

* The sulphate of potash may be replaced by good unleached wood-ashes.

range from three feet to seven feet. In the extreme north from one and a half to two and a half feet. In the middle and south the number, per acre, would, therefore, vary from 4,700 to 870, and in the south from 19,000 to 7,840.

The PRESIDENT. The convention will, I am sure, be glad to listen now to Professor Riley's paper upon the "Grafting of the vine."

Professor RILEY said that he would have much preferred to remain a listener, but inasmuch as he had been called upon at this juncture he would offer a few remarks upon the grafting of the grape-vine. We graft for various reasons. The apple is grafted on to one stock or another to perpetuate particular varieties. The pear on to quince for the same reason, and because it is hardier thus grafted. The cherry on to mahaleb, mazard, or mavello stock for similar reasons. It has not been very generally the custom to graft the grape-vine, because the beneficial effect has not been so noticeable. This, however, is due to the method of grafting, which has been almost uniformly below ground. With this method the graft soon makes its own roots. In the existence of the grape phylloxera and its work we have an additional incentive to grafting the grape-vine, and before I proceed further with this branch of the subject let me give you a brief sketch of this insect and its ravages.

This insect is interesting as offering an illustration of the difficulty that is often encountered in solving the problems that present themselves in economic entomology.

The insect exists both above and below ground, forming galls on the leaves and swellings on the roots.

There are several generations during the season of these virgin females, all of them laying eggs without the intervention of the male sex. As early as July there begin to appear, not in the galls but on the roots, pupæ, which are destined to produce winged females. These females fly through the air and deposit their eggs upon the under side of the leaves of the vines. From these eggs are hatched the individuals which are sexual; that is, males and females, and these individuals are, strange to say, perfect as soon as they hatch. The female, as soon as she is impregnated, deposits one large egg.

This egg is the only impregnated egg produced by the species, and passes the winter either in the ground or under the loose bark of the older canes. In the spring there hatches from it what may be called the stem mother, which begins anew the cycle of development in the species, and which may either settle on the root or upon the leaf forming either the galls or the swellings, as shown in the diagram before you.

The gall insect is comparatively inocuous, though some kinds of vines may be covered with the galls until they become defoliated, and this may go on from year to year without serious injury to the vine; but the root insect, unseen and unnoticed, and therefore less known to the grape-grower, acts very differently. It produces abnormal swellings of the rootlets, as shown on the diagram, which, in time, rot, and as the insects increase in numbers, the larger roots are finally affected, until at last the whole root system perishes. The outward effects are a yellowing and dwarfing of the growth, and soon death ensues. This is the disease that has attracted so much attention in France since 1869, and which was first called *pourridie* or rotting.

In 1871 I had the pleasure of proving by examination in France that the insect that was doing this injury was identical with that we have here, but which we knew only in the gall condition at that time. In

returning from France I found that the root insect was at work here just as it was there. I discovered that this rotting of the roots was going on here through this cause, though hitherto unknown to our grape growers. I made a number of examinations in the field, which showed that our indigenous vines have a greater or less power of resisting the attacks of the insect according to their species. We find that our cultivated vines suffer according to their origin. The European vine—the *Vitis vinifera*—is more susceptible, and, whether east or west of the Rocky Mountains, it succumbs to its attacks. It matters little whether in California, Washington Territory, Missouri, or Ohio, wherever this insect occurs the European vine succumbs to its attacks, regardless of climate or other conditions.

I cannot, therefore, help believing, when these facts stare me in the face; when I know that vines that were considered thrifty, reliable vines ten or twenty years ago in this country, have since been abandoned, that it is not due to the climate alone, but very largely to the insidious workings of the Phylloxera. I do not in any way deny the injurious effects of mildew, and the difficulty of overcoming it, but I do maintain that it is but one cause of the failure of the European vine here, and that Phylloxera is another and still more potent cause of failure, though less easily observed and recognized. I cannot fully accept the remarks of Mr. Sargent, in his paper of this morning, that the Phylloxera is less injurious in California than in Europe; for if we are to depend upon the recent investigation of the State viticultural commission, there are the greatest reasons for fearing that it will continue to devastate the vineyards in every section of the State, as it already has done in the Napa and Sonoma valleys.

There is nothing more sure than that we have varieties which effectually resist the Phylloxera, and others which succumb in a varying degree, and that grafting the latter on the former furnishes us with one of the best preventives against the disease. Let me, therefore, come at once to the subject of grafting.

Mr. PORTER. Is this ability to resist owing to the vitality of the root to restore by renewed growth?

Professor RILEY. In some measure it is due to the greater vigor of the root-growth, which is characteristic of our indigenous species as compared with the European. There are many other explanations that may be offered, and which I have recorded in my writings on the subject. Among these I would mention the fact that the insect is indigenous to North America; that it has always existed here, and, on the principle known to naturalists as the survival of the fittest, our present native vines are those which have successfully resisted these attacks in past ages. The European vine, on the contrary, has not been accustomed to this trouble, and being more tender and highly developed, suffers more from it, very much on the principle that a disease is always more virulent when first introduced among peoples that have never before suffered from it. Again, in the devastated regions of Europe the vine is the principal plant cultivated, and the winged female, which disseminates the disease through the air, has consequently no difficulty in finding vines on which to lay her few eggs; whereas, with us, our vineyards being scattered, a large proportion of such winged females will perish by settling on intervening crops and forests.

It must be patent to you all that in order to avoid the injury of the insect that attacks the roots, and to which I have just referred, the grafting must be done in such a manner that the stock chosen for this resisting power will retain its influence upon the graft by retaining its

roots. The advantages of grafting the grape are so manifold, even putting the Phylloxera out of the question, that the subject is well worthy of our consideration. New and rare varieties are easily increased and untried varieties easily tested, while worthless varieties are readily changed to desirable ones. It is important to bear in mind in this connection that the grape vine, having a very thin inner bark or liber, does not graft with the same ease as do many of our common fruit trees, and that more care is therefore necessary in the process.

I now take the liberty of reading from some of my previous writings on this subject; the more willingly that Mr. Husmann, in the recent edition of his work on grapes and wine making, does me the honor to quote the remarks in full.

Cleft grafting is the more ordinary mode employed, and it is usually done by digging away the earth, and inserting the graft very early in the spring, 2 or 3 inches or at the first smooth place below the surface. A horizontal cut of the stock is generally made, but a sloping one is, perhaps, preferable, from the fact that it enables all the gummy matter and excessive moisture which oozes from the cut to run down, and not accumulate to the injury of the cion. Fuller recommends grafting in the fall, and while this method is not deemed so advisable in Mississippi Valley, where there is such continued alternation of freezing and thawing, which is apt to lift the cion and separate it from the stock; yet it may elsewhere be followed profitably.

But valuable above all other experience is, perhaps, that of Mr. George Husmann, and I take pleasure in giving that experience, as he has kindly communicated it to me:

DEAR SIR: As you wish to have my views of grafting the vine, especially with the object of grafting some of our varieties most subject to the ravages of the Phylloxera upon roots of varieties which resist it, I will cheerfully add my mite to the researches which have already thrown so much light upon the history and the failure of so many of our otherwise most valuable varieties. My first attempts at grafting the vine were made in the spring of 1852, nearly 30 years since, and were made by grafting the then rare varieties of Norton's Virginia and Herbemont upon five-year old Isabella roots. I found in the first edition of A. J. Downing's "Fruits and Fruit Trees of America," a few remarks on the practicability of grafting the grape below the ground, which led me, then a novice in horticulture, to try it, and with eminent success. I took the ground away from the crown of the vine until I came to a smooth place, then cut off the stock, split it with a grafting chisel and inserted from one to two cions, according to size of stock, cut to a long wedge with shoulders on each side. I used no bandages, as the stocks were strong enough to hold the cions firmly, and only pressed moist earth on the cut to cover the wound. This was done on the 22d and 23d of March, and the cion covered and shaded to the top bud. About three-fourths of the grafts grew vigorously and fruited the next year. They have produced heavy crops ever since, and some years since I still found them vigorous and healthy, while the Catawbas around them have "passed away" several years ago. I have practiced various methods since, with more or less success, and still think this the best and most practicable, though it is neither an easy nor a pleasant task, as it must be performed when the ground is still cold and moist, and requires a good deal of stooping. The success of the operation depends entirely on a good junction of the liber of stock and cion, and therefore requires a steady hand and a good eye to push the cion to its place. My friends, the venerable Fr. Muench and Samuel Miller, practice about the same method, and are both almost invariably successful. The cions should, if possible, be cut in fall and kept on the north side of a building or fence, so as to remain dormant. Should the stock not be strong enough to hold the cion firmly, it should be tied with basswood bark, or an oblique cut be made instead of a split. This is preferable in small vines anyway, as by so doing the fibers of stock and cions are both cut obliquely, and therefore make a closer fit.

There are other different methods. Another, which I will mention here, has been practiced at Hermann with very good success, though I have not been very successful with it. It has the advantage of saving the vine provided the graft does not take. It is done by simply making an oblique cut into the stock below the surface or crown, and inserting the cion, cut to a rather blunt wedge, by bending the stock to one side, and thereby opening the cut. If the cion takes, the stock is cut off above it. Another method is grafting under the bark later in the season, when the sap flows freely and the bark peels readily; a long, slanting cut is made on one side of the cion, the stock cut off square, the bark lifted with a knife, and the cion pushed down under it. Every one who has practiced budding will readily perform this operation. The stock is

then tied with basswood bark. I have followed this plan with varied success later in the season, but prefer the first method.

GEO. HUSMANN.

SEDALIA, MO., *December* 20, 1874.

It will be noticed that the above experience and directions refer solely to grafting underground. Both Fuller and Husmann deem grafting above ground impracticable in our climate, principally on account of our winds; and their advice has been so very generally followed that little attention has been given to this mode of grafting the grape vine. The consequence is that we have the most conflicting experience as to the results of grafting; for, by the underground methods, the graft will make its own roots in the course of a few years, unless very great pains are taken to prevent such an occurrence; that it has done so in the majority of cases of grafting in this country in the past, admits, I think, of little doubt. Yet, in grafting as a means of counteracting the Phylloxera, the first requisite is to prevent the graft from making any roots of its own; for it must be remembered that we are dealing with a root malady purely, and that the object is to grow those varieties whose roots succumb more or less to the attacks of the insect, by using the roots of those which resist; this object is necessarily frustrated in proportion as the graft forms roots of its own.

There are two methods of grafting above ground, which I have every reason to believe may be made more successful than grape growers have hitherto been led to suppose. The first is by temporarily making a false surface and grafting in the ordinary manner just described, *i. e.*, instead of digging away the earth and inserting the cion two or three inches below ground, it should be inserted two or three inches above ground and the earth thrown up around it, to be removed only after the graft is thoroughly and permanently joined. There will then be no danger of the graft forming its own roots; and it is certainly as easy to throw the earth around the vine as to dig it away, while the mechanical work can be much more conveniently and agreeably performed above than beneath the surface. No doubt this mode of grafting needs greater care to make it successful, especially in a very dry season, as the mound is more apt to dry out than the level ground. Yet there is not lacking evidence that this method will work well in our soil and climate. Mr. John Vallet, of New Haven, a grape-grower of much experience, has had eminent success in thus grafting above ground, employing flax twine and paw-paw bark for bandaging. He considers that the vine grows more vigorously and that there is less danger of separating the graft when once formed, as there is no necessity for going below ground to destroy the suckers, the doing of which sometimes loosens the graft.

The second method is by inarching. This system of grafting does not seem to have been much practiced in this country, yet while it requires great care, and success may not as often crown the effort as in the former methods, I hope more attention will in future be given to it.

The operation is comparatively simple: A slice 2 or 3 inches long is cut from one side of the vine to be grafted, and a similar slice from the vine which is to serve as stock, as near the base or butt as possible. The two cut portions are then brought face to face, so as to fit as neatly as possible, and are then bound together with cord, basswood bark or other grafting bandage, which should be kept moist with moss. In the course of a fortnight partial unison takes place, when the bandage should be somewhat loosened to admit the expansion. In six or eight weeks, if the operation is successful, the stock and cion are firmly united, when the bandage may be removed. The graft immediately below the union and the stock immediately above it should then be partially severed, and in a week or so more entirely cut loose.

While, as already stated, this mode has not been much practiced in America, sufficiently successful results have been obtained to encourage further trial; and, as an example, I will mention one instructive instance communicated by my friend Isidor Bush. One of his customers, Eugene Cambre, of Nauvoo, Ill., has for some time furnished him with a superior quality of Delaware wine; and being anxious to know how Mr. Cambre succeeded so well with the Delaware, when so many others in the same neighborhood failed with it, Mr. Bush inquired as to the reason, and found that it was Mr. Cambre's custom in planting a Delaware vineyard to plant alternately with a Delaware a wild vine from the woods, and to subsequently transfer the Delaware on to the roots of the wildling, by this system of inarching.

The Delaware is among those which suffer materially from the Phylloxera, and several other cases of its successful growth when grafted on to wild vines, where on its own roots it failed, are on record.

Mr. Cambre's method is as follows:

For this method it is desirable that two plants, one each of the variety which is to form the stock and one of the scion, be planted close together, say about one foot apart. In June (the first year, if the plants make a sufficiently strong growth; if not, the second year), or as soon as the young shoots become sufficiently hard and woody to bear the knife, a shoot is taken from both the stock and the scion vine, and at a convenient place, where they may be brought in contact, a shaving is taken out from each

of these, on the side next to the other, for a length of 2 to 3 inches. This must be done with a smooth cut of a sharp knife, a little deeper than the inner bark, so as to obtain on each a flat surface. They are then fitted snugly together, so that the inner bark joins as much as possible, and wrapped securely with some old calico torn in strips or soft bass strings. Besides this, it is well to place one tie a little below and one above the grafted point, and also to tie the united canes to a stake or trellis to insure against all chances of loosening by the swaying of the wind. The rapid swelling of the young growth at this period of the year makes it desirable that the grafts be looked over after a few weeks, replacing such ties which may have burst, and loosening others which may bind so as to cut into the wood. A union will generally be made in the course of two or three weeks, which will be further consolidated in the course of six to eight weeks, when the bandages may be removed and the grafted portion left exposed to the sun, to thoroughly harden and ripen it. The shoots themselves are to be left to grow undisturbed for the rest of the season. In the fall, if a good union has taken place, the cane forming the scion is cut close *below* its union with the stock cane, which in its turn is cut close *above* the connection. Supposing the stock to have been a Concord and the scion a Delaware, we now have a vine of the latter entirely on the strong, vigorous root of the former. Of course constant vigilance must be exercised to prevent suckers from starting out of the stock. It is well to protect the grafted joint the first few winters by a slight covering of straw or soil to prevent frost from splitting it apart.

Mr. Cambre, in giving his experience, writes: "I have positively abandoned cleft grafting; it is too much trouble and too uncertain, and the graft often makes its own roots. I assure you that from a long experience in inarching I am of the opinion that not alone the Delaware, but most of our cultivated varieties will do better on native wild roots than on their own. I have 14 acres of vines, mostly grafted in this manner on wild stocks, and I have not lost one of such grafts. It is preferable to graft at from 10 to 15 inches from the ground."

Another mode of grafting above ground is thus given in "The Cultivation of the Grape," by W. C. Strong:

In The Gardeners' Monthly, Vol. II, p. 347, is a description of a mode practiced with success by Mr. Cornelius, which we copy, not merely as it is interesting in itself, but also because it illustrates many other modifications in grafting:

After the first four or five leaves are formed, and the sap is flowing, you choose the place on the vine where you intend to graft. At that point wrap tightly a twine several times around the vine. This will, in a measure, prevent the return sap.

Below the ligature make a sloping cut down; also, a similar reversed one above the ligature, about one inch in length. In selecting a scion prefer one that has naturally a bend. Cut it so that it shall be wedge-shaped at both ends, and a little longer than the distance between the cuts in the vine. Insert the scion, taking care to have the barks in direct contact, securing it with a string, *c*, bound round both scion and vine sufficiently tight to force the scion ends into their places. If the work is done well no tie will be required at *a* and *b*, but the joints should be covered with grafting wax. In a short time the bud will commence its growth, after which you can by degrees remove all the growing shoots not belonging to the scion, and in course of the summer you may cut off the wood above the bud, and in the fall remove all above *a* on the stock and above *c* on the scion.

Still another mode of grafting, which has, I believe, seldom, if ever, been attempted in America, but which has been employed with much satisfaction in France, and especially by M. H. Bouschet, of Montpellier, remains to be mentioned. It is the winter grafting of a cutting of such variety as is desired to grow, upon another which is to be used as stock, the combined cuttings being planted in the usual manner in spring, leaving only the buds on the graft proper out of ground. This is very similar to our ordinary mode of making apple grafts; and while we have little or no experience in this country on which to base anticipations, the method is worthy of trial, and is illustrated at figure 21.

Mr. PEFFER had had the Phylloxera in his vineyard several times in twenty years, and he found that the cold weather killed the eggs. The Clinton was most affected, and others that had smooth leaves. Those that have leaves with fur on the under side never had them. The Delaware was once affected, but that was on its own root. The Rogers was once affected with it, but it was not touched the next year.

A long and unimportant discussion on the subject of grafting followed, interspersed with remarks on the business to be brought before the convention to-morrow.

No new facts were elicited, and the report is therefore omitted from this record.

The convention adjourned at 5.25.

WEDNESDAY, *January* 18.

The convention was called to order at 10.52.

The PRESIDENT. The question of horticulture and wine making is still before the convention. Mr. Saunders, who has charge of the horticultural division of the department, will address the convention upon that subject, and I will leave the convention in his hands for the present.

Mr. SAUNDERS. I shall not take up the time of the convention with any extended address. I propose to make a few remarks upon this subject somewhat desultory in their character, and I perhaps may better illustrate what I wish to say by a supposition. We will suppose that we select twelve or any number of native grapes. We may have one or two foreign grapes, also, if you please. We plant them side by side here in Washington, or anywhere else, and watch their progress.

We will find that as summer advances and growth goes on that some of these grapes are making fine growth, ripening their wood, and presenting a perfectly healthful fine foliage. The next grape alongside has done tolerably well until the middle of July, when the leaves have become spotted. It continues to grow worse, until toward the end of August, when there is not a leaf left. Some will be robust while others will be the reverse.

Now the next year we prune these vines; we find that those that lost the leaves early last summer come along weakly the following spring, and if the season is favorable to this condition of leaf blight, we will find it is generally fatal; others will exist for years while a few will come on, keep robust, and do well. We will suppose as we go along, and I will not suppose anything that I have not actually seen, that one of the branches of a vine that lost its foliage in this way catches into a tree. We will find that that portion of that vine will retain its foliage well, while it goes on and ripens its wood the same as the strongest, whereas a branch of the same vine trained to a trellis goes on as before, the leaves become yellow and diseased, and the vine droops and fails to mature. Now, these are conditions which we find ordinarily, though sometimes there is great loss before we find out which it will be well to plant. There seems to be nothing in the plant itself which will indicate whether it is to do well or not. Now, suppose that we endeavor to grow artificially what we have seen in the tree. We will cover our trellis with a board sixteen inches wide, and we will find that underneath that cover that the grape does much better even with this slight protection than it does when not so protected. This teaches us that we may construct a covered trellis on purpose to grow grapes. I have seen them constructed so that the average width was about 24 inches with a trellis underneath, and with such a device all of your grapes will be found healthy, and your foreign grapes will do fairly well, even in this climate, with just such a protection.

Now we begin to ask the philosophy of this. We will take two registering thermometers, hanging one underneath this cover and the other one in the exposed area, say three feet from it. We look at them on a bright July morning after a clear night and we find that the exposed thermometer has been down eight degrees—I have seen it ten—eight degrees lower than the one that has been protected under the cover. We begin then to see that the cover arrests the radiation of heat; that it is arrested in its upward course, and no dew is condensed. We find a plant alongside this thermometer dripping with dew, and in a few days sometimes,

under these conditions, we will find that the leaves of this exposed part are becoming blighted, and in a few weeks they are gone. What does this teach us? That the injury is caused by dew. Now let us extend our views a little over the country. We find that what we have seen in this little experimental patch is being repeated only on a larger scale. That there are portions of the country where all grapes do well, and portions where those grapes do well that resist any inclemency of the weather, and these few thrive almost anywhere in the country; but we find, as I said before, a special locality where they do especially well, and that is the locality where there is little or no dew. That is the whole story about grape mildew, and I do not wish to take up the time of the meeting on this point. I think myself the question is a very important one, and I have mentioned it only to show that all of the diseases of the grape, all of its casualties, all of the reasons why we cannot grow certain grapes, are not owing to an insect either at the roots or anywhere else. In this connection I can perhaps best express my opinion by reading from an article I prepared some seven years ago upon this subject:

For several years past considerable attention has been given to the grape-root insect, and the injuries it inflicts upon vineyards, both in this country and in Europe. Its life-history appears to have been thoroughly studied; its curious and somewhat perplexing transformations have been elaborately explained by entomologists of both continents, and its destructive capacities duly chronicled.

Grape growers possess their full share of that propensity in mankind which is manifested in the tendency to shift responsibilities; and all failures in grape-culture, with but little of hesitation, are freely and willingly attributed to this diminutive insect. Unless we ignore an almost overwhelming amount of clear and direct evidence, it cannot for a moment be doubted that the Phylloxera has worked great devastation and caused great losses; but when it is asserted that all failures in grape-culture in this country are traceable to its ravages, it then becomes apparent that the insect is falsely accused, and that the assertion conveys a flagrant error, for which there is no intelligent excuse.

It has been distinctly stated that the failure of the European grape in this country is owing to the ravages of the Phylloxera. With as much truth the statement may be made that the failure of the orange-tree on the slopes of the Adirondacks is due to the presence of this insect.

The true cause of the failure of the foreign grape in ordinary field culture is now so fully understood, that it seems almost superfluous to state that it is solely due to atmospheric influences, as is clearly shown by its successful culture in glass structures in all parts of the country.

In the spring of 1863 a purposely-rude glass structure was erected in the garden of the department for the purpose of illustrating the cause and effects of mildew on the grape-vine. The appearance of this structure will be best understood by supposing an inclosure made by placing a few glazed sashes against a common board fence. A collection of grapes, comprising both native and foreign varieties, were planted two feet from and parallel with the front of the house. In due time two stems were procured from each plant, one of them being introduced under the glass roof and the other trained to an upright trellis set four feet from the front, fully exposed to the atmosphere. This arrangement was maintained for seven years, during which time the branches under the glass cover remained in perfect health and annually produced crops of well-ripened fruit. On the other side, the branches on the exposed trellis, with the single exception of the Concord, were more or less injured by mildew each season. The Iona branch under cover produced branches so perfect, both in size and quality of fruit, as to suggest a recommendation for its culture under glass, as published on page 25 of the annual report of the department for the year 1867. The branch of this vine on the exposed trellis never ripened a berry, and after struggling for a few years against mildew, the loss of foliage during summer, and the destruction of unripened wood during winter, it ultimately succumbed.

The foreign varieties, Black Hamburgh, Black Prince, and White Frontignac, shared the same fate, only more rapidly. Among natives, the Rebecca, Maxatawny, and Delaware, on the trellis, occasionally ripened a few branches, accordingly as mildew more of less prevailed, while the protected branches never failed to ripen perfect fruit. Occasionally the position of some of the branches were reversed, the inside branch withdrawn and fastened to the outer trellis, and its place in the house given to the branch it displaced on the trellis, and the result was in all instances alike. These

are not isolated experiments. Horticultural literature is replete with corroborative evidence of a similar nature, and if the history of every vineyard in America could be minutely recorded, it would be found that success followed immunity from mildew, (or leaf blights, as some prefer to term it), or fungoid diseases in either form, and that failures as surely followed their presence; and the statement is not presumed to be made that this intermittent action was due to the erratic movements of Phylloxera.

Neither will the claim be seriously entertained that this insect exercises an influence in promoting the health of vines when their foliage is protected, either by a glazed or a boarded covering: that the resulting loss of foliage, disease, and weakness, when the covering is removed, is caused by their active presence, and that they again abandon the plant, and permit it to assume health and vigor when the protective cover is replaced; if so, then the much-sought-for and highly-valued remedy for the Phylloxera is readily obtained.

The fact that the Phylloxera is found on the roots of sickly or dying grape-vines is not to be taken as conclusive evidence that the destruction of the plant is solely the work of the insect, since the presence of insects upon diseased organisms is of common occurrence both in animal and vegetable life.

It is a significant fact that, if we compare the list of varieties said to be least affected by the Phylloxera with the list of varieties least subject to mildew, we will find them to be identical.

The sum of the whole matter, then, appears to be this: that when a grape-vine becomes weakened from successive yearly attacks of mildew, destroying the foliage, so that the wood or shoots fail to thoroughly mature their growth, its vitality is so impaired that what little of life remains is easily vanquished by the Phylloxera.

It has been recommended to graft the Iona, Delaware, Catawba, and other varieties infested with the root-louse on roots of the Clinton, Oporto, Concord, and other kinds that resist its attacks, as a means of securing immunity from its ravages. It may safely be predicted that the results expected will not be realized. The same causes that rendered the Iona unprofitable on its own roots will render it unprofitable when grafted on the roots of the Clinton; and it would not be at all surprising if the then weakened roots of the usually robust Clinton be found badly infested with the Phylloxera.

If this method of grafting had proved successful, our vineyards would be planted with the most esteemed grapes of the world; but the experiment has often been made and as often failed.

If we look into the history of European grape-culture during the past thirty years, we learn that previous to the year 1846 the crops were satisfactory and the wine-producing interest prosperous. In that year the grape-mildew made its appearance near Paris, and soon spread over vineyards in neighboring districts, from whence it traveled with great rapidity over the south of France, Italy, and Hungary. In 1851, it had crossed the Mediterranean, invading Algeria, Syria, and Asia Minor, destroying the wine-commerce, and bringing ruin to the owners of vineyards. In 1852, it appeared in Maderia, and worked such devastation, that in 1856, only 200 pipes of wine were produced as against 14,000 pipes produced in 1850 in that island.

The losses incurred and the destruction occasioned to vineyards by this malady were beyond calculation; thousands of acres were abandoned, and in those not utterly destroyed the vines were weakened by the disease and produced only inferior crops. About the year 1863, it was discovered that the roots of diseased vines were covered with excrescences, and continued observations proved that this malady was increasing with fatal rapidity.

In 1868 a memoir was presented to the French Academy, detailing a new disease, which, the writer thought, was "likely to prove more disastrous than the mildew. This new enemy was an insect, a minute *aphide*, which formed yellow parasitic patches on the roots of the grape-vine." This "new enemy" has since received the name of *Phylloxera vastatrix*.

The warty, knotty processes, now so familiarly known as indicating the presence of Phylloxera, are not by any means a modern production. They have long been observed on the roots of grapes; but it is only when the plants are otherwise diseased and their normal vitality impaired that the insects prevail to a fatal extent.

Various kinds of *aphides* have existed on the roots of plants from time immemorial.

If, as maintained by most entomologists, the leaf-gall-producing insect and the root-louse are identical, it further confirms the accuracy of the foregoing observations and deductions. Among all the varieties of grapes, native or foreign, that have come under observation, I do not recall to mind any one kind that has been so frequently or so severely attacked by the leaf-gall insect as the Clinton. But this variety is so healthy, so exempt from fungoid diseases, that all attempts of the insect to fatally injure its roots are abortive; a result that may be expected of all other varieties so long as they retain a similarly healthy condition.

Mr. SAUNDERS said that there are two very distinct kinds of mildew,

one caused by too much dryness, the other by too much dampness. We rarely have our native grapes injured by the aridity of the atmosphere; but in those climates, like England and Holland, the upper surface of the leaf is frequently covered with a white, mealy deposit. That is the reason we cannot extend our season. We see it occasionally on the foreign grape, in the early part of the season; later, the foreign grapes are covered with this mealy deposit which produce the spores in the fall, injuring them still more. The causes which produce it are thought to be sudden changes. He had brought it on. He had taken a peach tree out in the cold, and then put it in a hot-house, and a blister would commence to appear in a few days. This has been attributed to insects, but the blistered leaves are found as often without the insects.

Mr. CUTLER, of New York, had visited Hampton Court palace, and was shown an old grape-vine that had existed one hundred years, upon which was a good supply of fruit, and over which they kept glass.

Professor RILEY said that no one could appreciate more than he the soundness of most everything that Mr. Saunders had said in relation to grape culture, the needs of the grape, and the peculiar atmospheric conditions under which the grape will most successfully grow. He wished, however, to disabuse the minds of the convention of the idea which Mr. Saunders' remarks may have led it to entertain, that all diseases of the vine have been attributed by himself to Phylloxera. Mr. Saunders knew very well that he, more than any other entomologist, had protested against the inclination. Mr. Saunders had not touched the vital point that he makes, viz., that the Phylloxera was a factor in the failure of many of our grape-vines. He was aware that few could appreciate the injury that the insect is capable of, who have not followed it around from vine to vine and from vineyard to vineyard, year after year, as he had done.

Professor Riley indorsed all that Mr. Saunders said about the effect of climate upon different species; but the varieties that fail ordinarily in a good climate do well in this latitude. The reason why a vine will not succumb during the first year's growth is, because it takes two or three years for the Phylloxera to attain injurious proportions. Many of our varieties which have failed would do well if you could keep the Phylloxera from them. The whole family of plant lice to which this belongs feed upon vigorous, thrifty plants, and not upon diseased or decayed plants.

Dr. MCMURTRIE said that he had long been of the opinion that anything that will have a tendency in any way to weaken the vine will give an opportunity for the attacks of disease upon it, and whether it be the Phylloxera upon the root, the insects upon the vines or the leaves, or whether it be deficient nutrition of the vine, or whether it be excessive radiation of heat from the vine during the summer nights to interrupt the vegetative process—any of these things will give an opportunity for the attacks of blight or mildew, to which the leaves are subject, and they will be more likely to succumb. I think it may be stated as a fact that those varieties which are the most vigorous, which produce the best and strongest leaf growth, are less subject to attacks of disease than other varieties. It has been found in the south of France that certain varieties of American vines are less subject to attacks of Phylloxera than others, and if we take the results of observations made there with regard to the likelihood of the different varieties to succumb to attacks of Phylloxera, we find that the weaker varieties with this regard are generally those with which we have most trouble from blight and mildew. It is true, as Professor Riley says, that the Phylloxera

acting upon these varieties may have a tendency to so weaken the vines as to subject them to disease.

In the nutrition of the vine Dr. McMurtrie thought that the question of the soil had a great deal to do with attacks of disease. We hear statements of a vine's bearing four, five, or six years, and then being attacked by mildew or blight; but, at the same time, we hear nothing of supplying the nutrition of the vine by the application of suitable fertilizers. Vines starting out and bearing heavily at first exhaust the soil, which, in lands generally selected for vineyards, is not over rich, and this exhaustion indirectly weakens them and makes them liable to disease. He thought this might be largely remedied by the application to the soil of such elements as are found to stimulate the vine. In an experiment in 1877, which he had never had the opportunity to complete, he found that if the plant was supplied with mineral nutrition annually and brought up to a certain stage, and then the nutrition taken away, the plant immediately went into a weakened condition, and all sorts of molds were found on its leaves at once, whereas plants right alongside in boxes submitted to the same conditions, and having the necessary nutrition, were not affected at all. From the fact that we found that vines will run along four, five, or six years, and then succumb all at once, he believed that this effect of nutrition might be considered as an important factor in the question of diseases, another point which we cannot avoid. Mr. Saunders had called attention to the fact that radiation being interrupted produced good effects; there is no doubt but that is also an important factor.

Mr. PORTER, of Virginia, agreed with the last speaker. In Virginia a gentleman had made as high as $1,100 to the acre. He had succeeded in ripening the Delaware by practicing restoration by nutrition. He practiced the cutting back of his grapes, allowing them to go out of bearing for awhile. He does not allow the production to exceed five pounds. He plants twice as many to the acre. One of the largest planters there now plants 4×6, the usual number being 8×8; he don't intend to produce over $2\frac{1}{2}$ pounds to the vine. He was not a believer in excessive production. He had seen vines with a half a bushel upon them, but not a single cluster of perfectly ripe grapes among them.

Mr. PORTER. Is there any evidence at all that Phylloxera did not exist or was not known to exist before its ravages were known in Europe? It was stated on yesterday that they have always existed here.

Professor RILEY. In regard to the existence of the Phylloxera in Europe, we have very full evidence on that point, for the reason that the disease is conceded to have originated in those localities in France where the American vines have been introduced. In Europe it has spread from such centers of infection. There is no evidence of the disease having ever existed there before the time Mr. Saunders mentioned, but during the decade between 1860 and 1870, or a little prior, it was first introduced into France, as far as we have any positive record. There is no evidence to show that it existed on the wild vines or the cultivated vines of Europe, for the reason that I have shown. On the contrary, we have the most absolute evidence of its existence in America very early in the history of grape culture. The insect is, in short, indigenous here.

Mr. DANIELS wanted to hear from those interested in the actual growing of vines, who have made it a business; what their experience has been; what vines they have planted, and what practical results they have produced. A discussion of this character will clear up the difficul-

ties in the way of ascertaining and preventing the causes of the failure of the vine. The speaker gave an account of his own experience. In one case he had a gravel soil, one acre or so; he set it out with insufficient manuring, and every variety failed that he planted. He put in plows and tore it up, and put in a bushel of good compost with good results. Several varieties that could not grow in other parts of his place with less culture and less rich manuring succeeded well here. There every variety grew to advantage. When the dry time came they continued to get a magnificent growth. He then set out some Black Hamburgs with a similar result. This matter of nutrition is the prime factor in successful grape growing.

A Delegate who followed, said that he was more inclined to accept Mr. Saunders's theory, that the atmosphere had much to do with this question; that he had noticed that a succession of north wind, sunshine, and rain affected his vines. It was his observation if his crop passed the 22d or 25th of June it was safe.

Mr. DANIELS understood that Dr. McMurtrie holds that the injury does not arise from overbearing, and that if we properly feed, we can allow them to bear as much as they can.

Dr. MCMURTRIE. I simply wish to impress upon you the fact that the nutrition assists the vine in its work.

Mr. PORTER. To perform the work of overproduction.

Dr. MCMURTRIE. Overproduction amounts to this. In all cases there must be in the fruit a fixed relation between the organic and the inorganic constituents. If the supplies of nutriment from the soil be sufficient to meet the demands of these relations, development of the fruit will proceed normally and with no interference with the conditions of development of the vine. The soil must contain the constituents suited, as well to the production of fruit as of wood and leaves. If the soil do not contain them, the fruit must draw upon other parts of the vine and exhaust not only the reserve held for its present development, but it may even be deprived of those needed for future use as well. Two remedies for the difficulty then become manifest. Either the quantity of fruit must be reduced or the nutriment required to normally bring it to maturity must be supplied from external sources. But if the soil can supply this nutriment, the vine will by no means become exhausted should these supplies cause a larger production of fruit. You cannot make a horse thin by work if you feed him well and properly.

Professor RILEY. I would say that probably a very strong argument against Mr. McMurtrie's position is that all the modes of nutrition, stimulating, cultivating, and manuring have not proved susceptible of accurate determination, though partly so. But nourishment, continually, while it will improve them, will not prevent the attacks of insects in the end. If only the bearing of the vine were in question, there could be a remedy. That is not the idea. I believe there are various causes producing the death of all vines, but in these cases we must recognize every separate character. Mildew is one and phylloxera is another, and they each have their definite characters and their definite appearance.

Mr. HEUSER said that, in regard to the rot, he planted three acres on one side of a line and three acres on the other side. The one side is rich and affords sufficient nutrition, and he planted that with Concords ten or twelve feet apart. They came up well. On the other side the soil was poor, and he manured heavily, and the growth was very small and it was a hard matter to get young wood in late years perfectly

sound. From this experiment, he was inclined to believe that location has much to do with the determination of this question.

Dr. McMURTRIE. You say the rich land was on one side, and the poor on the other, which you manured. You put manures on and you did not get a large growth of wood on one side. It is well known to students of vegetable physiology that where nitrogen exists in large quantities you may have extended leaf and large wood growth without the proper adaptation for fruit production. You may exhaust the vines of the principles necessary for preparing the bearing qualities of the vine. But the remedy in one case, by the use of your constituents, will not necessarily produce the fruit. In the case where you found the condition on one side to furnish very fine wood growth, you have the other condition of no fruit. Yet the leaf would, through the application of your fertilizer, be sufficiently grown, though not what is necessary for the fruit production. Economic conditions meet all the demands.

The convention, after some further discussion, at which no new points were elicited, was announced adjourned for the usual recess.

The convention was called to order at 3 o'clock. After some discussion of an unprofitable nature it was suggested by Professor Riley that some of the delegates speak to the question of practical wine making.

Mr. REIERSON, of Virginia, spoke as follows:

Mr. CHAIRMAN: Although not prepared to properly discuss this interesting and important question, rather than it shall go by default, and with a view to drawing out others, I am willing to make the initiatory move, as I shall at the very threshold probably strike some one with conflicting ideas. I will therefore attempt to indicate a crude outline of the manufacture of the fruit from which we get a *pure* wine.

The first principle I would suggest for the making of wine out of grapes, is *absolute cleanliness* from the beginning, to be kept up to the very time when it is consumed, even though that be twenty years. I want the grapes cleanly picked, cleanly delivered, cleanly handled, ground with clean rollers, run into clean tubs, fermented in a clean vat, that vat cleaned when drawn off, the must again fermented in a clean cask, racked into another clean cask at proper times, on a clear, bright day. When ready for use I want it put into a clean bottle, stopped with a clean cork, that cleanly drawn out with a clean corkscrew, the wine poured into an absolutely clean glass, thin and of pretty good size, and drank with a clean mouth.

I consider that the very elementary principle essential to making good wine out of any grape, is cleanliness. The neglect of this at any stage of manufacture is, in my belief, ruinous. When thus neglected, no matter how good the grapes were originally, the wine is injured and you can clean it no more.

The simple process that I am familiar with in the making of pure wine has no mystery in it, though a great deal is attempted to be attached to it. It is true I have had but slight experience, but I have watched the mode and manner of its treatment very carefully for six or seven years, and the processes pursued by us with success. Notwithstanding it is simple, it is not always attended with success. The first question is as to the time necessary to ferment on the husk, if at all. This will depend on the kind of wine to be made—whether claret (red) or white wines. Whilst these differ, and different kinds of even red grapes require a different treatment, yet they are all simple as to each. In this respect, up to the present time, there is more uniformity in the adopted American wine grapes than those in Europe; hence the pro-

cess of manufacture is less diversified. Still, in France, where I am informed that the kind and character of grapes differ at a distance of but a few miles, even distinctly differing on the respective sides of a river, each little vineyardist makes his own must, which is sold to brokers from the large city cellars, who, being experts, tell in a moment, by the taste, whether the character of the young wine be such as by proper blending will result in the respective brands dealt in by each. Of this art of blending I am ignorant, and shall attempt no explanation. I bring in this parenthetically to illustrate the assertion that the making of pure wine—that is, preserving the juice by fermentation—is simple, each grape grower doing so in France. The blending of different kinds to bring about certain characteristics is an entirely distinct art, not so easily attainable.

We assume now that we are equipped with a proper cellar, grape-crusher, press, vats, casks, and other requisite appliances, and that the grapes are ripe. When grapes are wine ripe it means that the sugar is fully developed up to a high standard on the saccharometer. What that should be must be determined by each grape-grower, as to the kind of grape, and locality, which vary. We will say that the Norton grape should indicate 100 degrees to make a good wine. That, then, is your standard for that grape, though at times and in localities nature will develop it to 110 and over. If this be your standard, I mean that such Nortons as show less than that when tested must be brought up to it by the use of a good quality of pure sugar. The natural or added sugar is not to make a sweet wine; it is to be converted into alcohol by vinous fermentation, to such an extent as experience has shown, to bring about the most pleasant results, when mingled with the other constituent elements in a given kind of grapes. If, as is probably the case, there be too large an amount of acid in such grapes as are not perfected by nature, then that excess of acid must be diminished by the use of water. I am now touching upon ticklish ground, where there is a vast diversity of opinion, and controversy is endless. I hold that water should not be added to perfect grapes, and the minimum amount only to those that require the aid of sugar. This is honestly combated by a large class; they insisting that all our grapes have too much acid; that a liberal use of water is actually an improvement, resulting in better wine; that many of our wines are too full, made pure out of the perfect juice alone, fermented. This idea, in my opinion, has been and is being practiced largely in the West, to a ruinous extent, for the good reputation of our native wines. During the past fall I have seen Norton must so treated that instead of a very dark it came out a thin bluish fluid, without a particle of its elegant characteristics being perceptible either to the sight or the taste. This they call Gallizing! Dr. Gall never taught nor practiced any such drowning-out principle. His whole idea and method was to make the best wine out of the *imperfectly ripened* grapes, so often encountered in Germany, by the limited use of sugar and water. He did not *immerse* finely ripened grapes, as his so-called followers are doing.

Having now explained the idea of a standard and its regulations, I will take the Norton for illustration. The grapes should be gathered when perfectly dry, not with rain or dew on them. Let them be brought to the cellar as speedily as practicable after gathering. They are next run through the crusher, simply to break the skin, not to crush the berry or seed. This is to facilitate the fermentation in the vat, into which they are now thrown. The white wines want a different treatment here, but I will only carry through the process of the Norton.

When the skin is broken they do not go into the press, but the fermenting vat. These, of course, vary in size according to the extent of your operations; but a large one is preferable to the smaller, the fermentation being more perfect, especially in changing temperature, and the quality of the must more uniform. September and October is the time with us for this work.

A MEMBER. What period of fermentation should they go through?

Mr. REIERSON. No specific rule can be laid down as to time. That time and circumstances that had once yielded a good result should be adopted. The temperature desired at this stage I would designate as 70 degrees, with which, continued about or not exceeding 72 hours, brings about fine results, under my observation. The exact time must be determined by the character of the fermentation and the smell and taste of the must. Right here is where the character and quality of the wine is determined, and consequently this is the main point for the exercise of skill and judgment. In this process of fermentation, as the liquid is eliminated from the berry it sinks, and the husk rises to the top. If allowed to so remain the action of the air on it would rapidly develop acetic acid, which would *ruin* the entire contents for wine. To prevent this these husks must frequently be pressed down by a wooden maul, so as to be covered by the fluid; to aid which a false bottom may be used, fastened down at the top, and perforated with a number of holes to permit the escape of the carbonic acid gas developed. Whilst I designate 72 hours as the limit of fermentation as stated, and the necessity of pressing down the solid mass of husks rising, yet I have seen in the West what I was told were Norton grapes that had fermented for three weeks, and was expected to continue for three weeks longer. In these there was no need for labor to keep down the husks, for they had plenty of liquid to swim in without rising in a mass. This was perfect baptism, which I do not indorse. Some Nortons said to be thus made I drank, and found it fairly good, but not by any means what a Norton should be and can be made.

When the husk fermentation in the vat has reached the stage indicated the liquid must be drawn off through a spile hole near the bottom of the vat. To facilitate this, keeping it free from seed, &c., a bundle of grape-vines has been placed inside the vat, at the bottom, against the spile-hole, kept in place by weights. This operates as a rough strainer in drawing off the fermented must. This is now conducted by a hose, with copper strainer to hold back any grape seed that may be in it, to a well-cleaned and fresh cask, to continue its vinous fermentation. This is very violent, and therefore the cask cannot be filled. Still it should be so near full that the solid matter brought to the surface by fermentation may escape by the open bung-hole. This bung-hole is kept open till the fermentation grows gentler. Then the empty space is filled up, the bung inserted, through which a metal or rubber tube has been run, in the shape of a siphon; a half-gallon fruit glass jar filled with water is placed on the top of the cask, and the other end of siphon inserted in the water. This is to permit the carbonic acid gas to escape and at the same time exclude the air. A bag filled with sand, placed on the bung-hole, may be used instead of this siphon, but probacly not so satisfactory. The young wine or must is now in the cask safely fermenting, and to be so continued till the gas cease to escape through the water-jar. Then fill up and put bung in. Evaporation is heavy now, and the cask wants constant watching and filling up.

From this point till consumed, with continued cleanliness, the principle is, *keep the cask, barrel, keg, demijohn, or bottle* ALWAYS FULL. All

the liquid in the Nortons has not been drawn off from the vat; there is a considerable quantity in the husks. These must be taken out and pressed in the wine-press. The same process applies to Concord, except that some never press them at all, taking only the must that is liberated in the fermenting-vats. Generally, however, this process holds good as to all red-wine grapes.

At the season of the year when grapes are pressed here there is such a fall of temperature, naturally, that fermentation in cask is not completed, and consequently the unconsumed yeast-spores lie dormant till the heat of spring or summer puts them in motion, causing a larger or smaller amount of secondary fermentation. This is sometimes dangerous, tending to acetic instead of vinous fermentation. It is to be avoided if practicable, and, to this end, some cellars are provided with steam or water heating apparatus, to keep up the temperature artificially long enough to continue the original fermentation till completed. To this use of artificial heat I see no objection, as it is but an *aid* to *nature*. If not done the period of winter or cold weather is lost, the wine making no progress, except the deposit of sediment. It hastens maturity of the wine for use, but it is asserted that it diminishes its keeping qualities. Under favorable conditions the wines in the cask by December or January have deposited their first lees. This deposit of tartar, fermenting substances, coloring matter, salts, &c., is nothing but a natural clarification, and the clear wine should be drawn off. The sooner this be done after deposits are made the less liable are the wines to subsequent or secondary fermentation. They are put in a fresh, clean cask, perfectly filled, and so kept till say March or April, when they should be again racked or drawn off from any further precipitation of lees.

If no artificial heat be used, and the best treatment be given, then the wines should be again racked in June and September. The quality of the wines will differ the same season, made the same time, subjected to the same process, and out of the same grapes. Why this is so there is no explanation that is satisfactory. Its maturity may be hastened by frequent careful rackings, the change into smaller casks, and clarifying with eggs or gelatine. For clarifying, by which I mean the separation of all solids from the liquid, especially white wines, the filtering process is the best. Filtering, in some form or other, has been practiced as far back as we have any account of wines; but the modern resort to the use of filtering is the most satisfactory when required for large quantities. Many appliances for utilizing this most economically and expeditiously have been invented in Europe. A perfect filterer has been a desideratum diligently sought after, and now nearly, if not quite, reached, through the stimulating effect of our newly awakened interest in grape culture in the United States. Mr. Charles Farciot, now superintendent of the Kelley's Island Wine Company, in Ohio, is the inventor of a filterer, largely used in the West, some in California, and even taken to France, far superior to anything else of this kind. They are charged with as much as two or three barrels of filtering paper, through which may be perfectly clarified from three thousand to ten thousand gallons with one charge. It can be so simply placed in a cellar that, with the aid of a large receiving-vat, a force-pump, and hose, thousands of gallons may be moved from a given lot of casks, and the wine returned to those adjoining, with one single laborer at the pump; its clarification above the cellar being perfected, and return to new casks below being carried on by the simple, natural law that *liquids will seek their own level*. I perceived one difficulty, which was making a good charge of the filtering papers, so as to present a uniform and

compact surface, which would not be broken through by the pressure of the liquid. If broken in one place the entire charge went for nought. This he admitted was a difficulty; his skill was acquired by practice, and even then there would be an occasional failure. This, however, he thought he had overcome by a new modification, which would enable any careful man to charge it. The first and only one of these he had at work in November, 1881, which, if it has verified his expectations, will be *the* great labor-saving machine to the entire wine world.

With this imperfect general outline, I will close with this injunction to all wine makers: Be pure; be clean; be full. If not so yourselves, apply it to your wines, vats, and casks.

Mr. PORTER suggested the adoption of a resolution looking to a reform in the nomenclature of wines and a concert of action in this direction.

Mr. SAUNDERS thought that it would be impracticable to take any steps in that direction, as the trouble alluded to was being quietly overcome.

Dr. MCMURTRIE agreed with Mr. Saunders, and advocated a plan which should indicate whether the wine was red or white, sweet or dry, and then the name of the manufacturer, letting that name be the characteristic of the wine.

After some further discussion, Mr. Porter moved that the convention adjourn *sine die*.

On motion, the thanks of the convention were extended to Professors Riley, Saunders, Taylor, and McMurtrie for their valuable service during the sittings of the convention.

Mr. FOSTER, of Ohio, offered the following resolutions:

Resolved, That this convention thank Commissioner Loring for calling us together, for in doing so he has brought all sections face to face, and enabled us to give and receive ideas and methods relative to the management of all our varied interests pertaining to agriculture.

Resolved, That we believe that the continuance of these annual national conventions would be wise, either in Washington or elsewhere, and that they should be called by the Commissioner of Agriculture and under the auspices of the Department of Agriculture.

Resolved further, That we will give Commissioner Loring our hearty support in his efforts to make this department the grand and useful one it will be to all interests of our land while under his management.

The resolutions were unanimously agreed to.

The PRESIDENT, rising to put the motion of Mr. Porter, referred at some length to the difficulties that have always attended the manufacture of wine in different countries. From the knowledge he had gained of its manipulation everywhere, he had come to believe it to be a question of ingenuity. Professor Riley could tell us all about insects that attack the vine, but nothing of the causes that contribute to the difference that exists in the results obtained from the several manipulations of the juice of the grape.

The President concluded as follows:

In putting to you the motion of Mr. Porter, which is to dismiss this body, I cannot refrain from referring to the good results that have attended this series of conventions, nor from congratulating myself upon the work you have accomplished. I congratulate the country upon the valuable papers that have been presented here, some 18 in number; I congratulate the gentlemen who have been able to be present with us and to listen to them; and I congratulate and thank the gentlemen who have furnished us with the valuable information contained in them.

When I issued the call for this convention I felt confident that the agricultural colleges of this country were in full and hearty accord with each other, and I felt sure, moreover, that there was more capacity, more ability, and a greater desire for investigation among the agriculturists of this country than they themselves were aware of; that there was more science at work among them than the farmers knew, and that the great agricultural communities of this country had, by continued processes, been stimulated to that point where they were equal to all the demands made upon them.

We have had a convention devoted to the agricultural colleges and educational institutions of the country, and I have scarcely ever listened to a better discussion than was had during this series. We have had a convention devoted to the animal industry of the country. Following this was another series, at which the cereals were discussed, and intelligently, too; and now we are about to close a two days' session upon the horticultural and vinicultural interests of the country, and no better commentary could be passed upon this last convention than is found in the interest which has never flagged for one moment, and the reluctance with which the motion is made that we now adjourn.

There have been, as I say, some 18 valuable papers read at these conventions, and I am sure there cannot be found among them all a paper unworthy of a place before the best agricultural college on earth.

I hope the assembling of these representative gentlemen from all parts of the country will be followed by the good results I anticipate, and, should we have another convention at a future time, I trust that every State in the Union will be represented as ably as have the twenty at this series, and that ere that time agriculture will have taken one more step in that progress which it is destined to make.

To the delegates who have responded to this call I owe my thanks for the various contributions to the success of the past eight days; and now, wishing you all a safe and happy return to your homes and families, and assuring you that you take thereto my best wishes for your health and prosperity, I declare this convention adjourned without day.

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